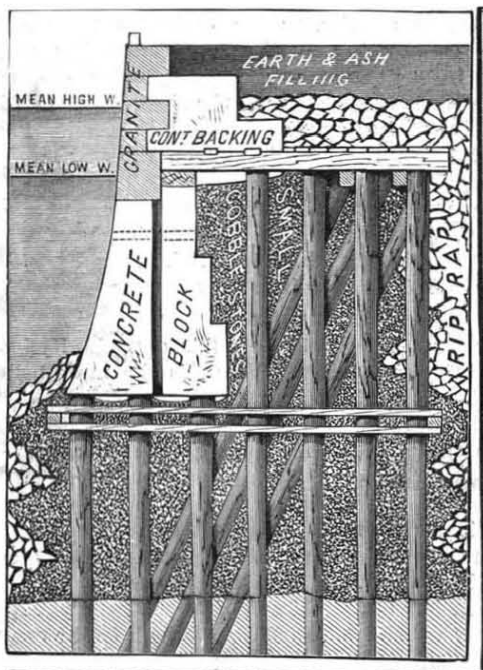
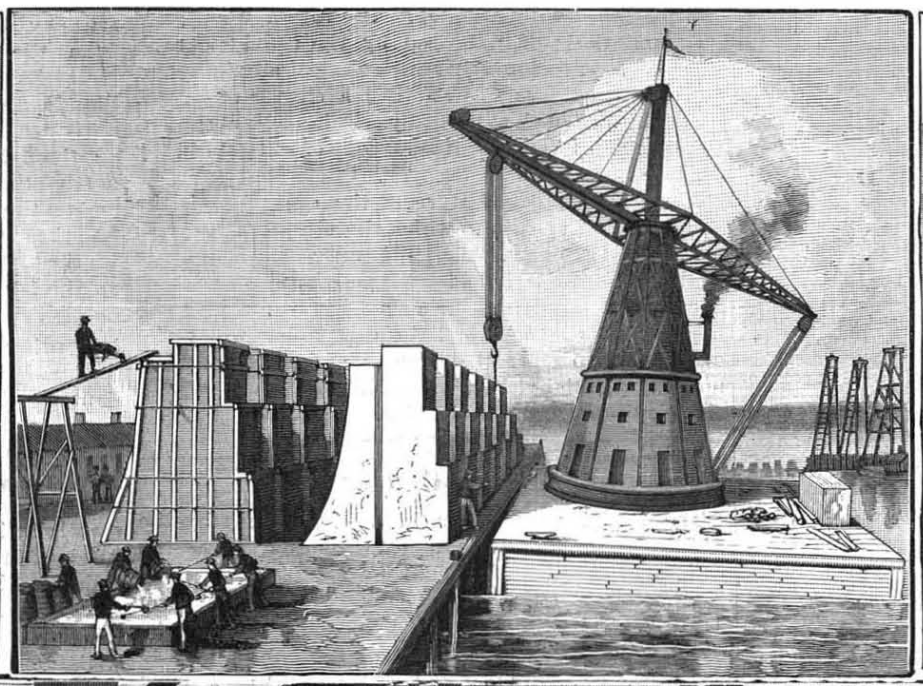
SCIENTIFIC AMERICAN

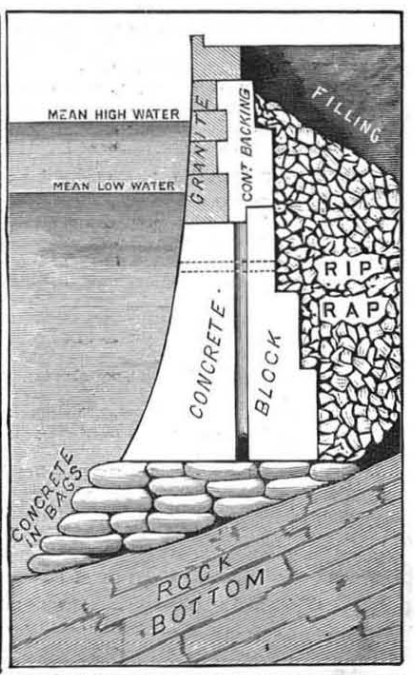
[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyrighted, 1889, by Munn & Co.]

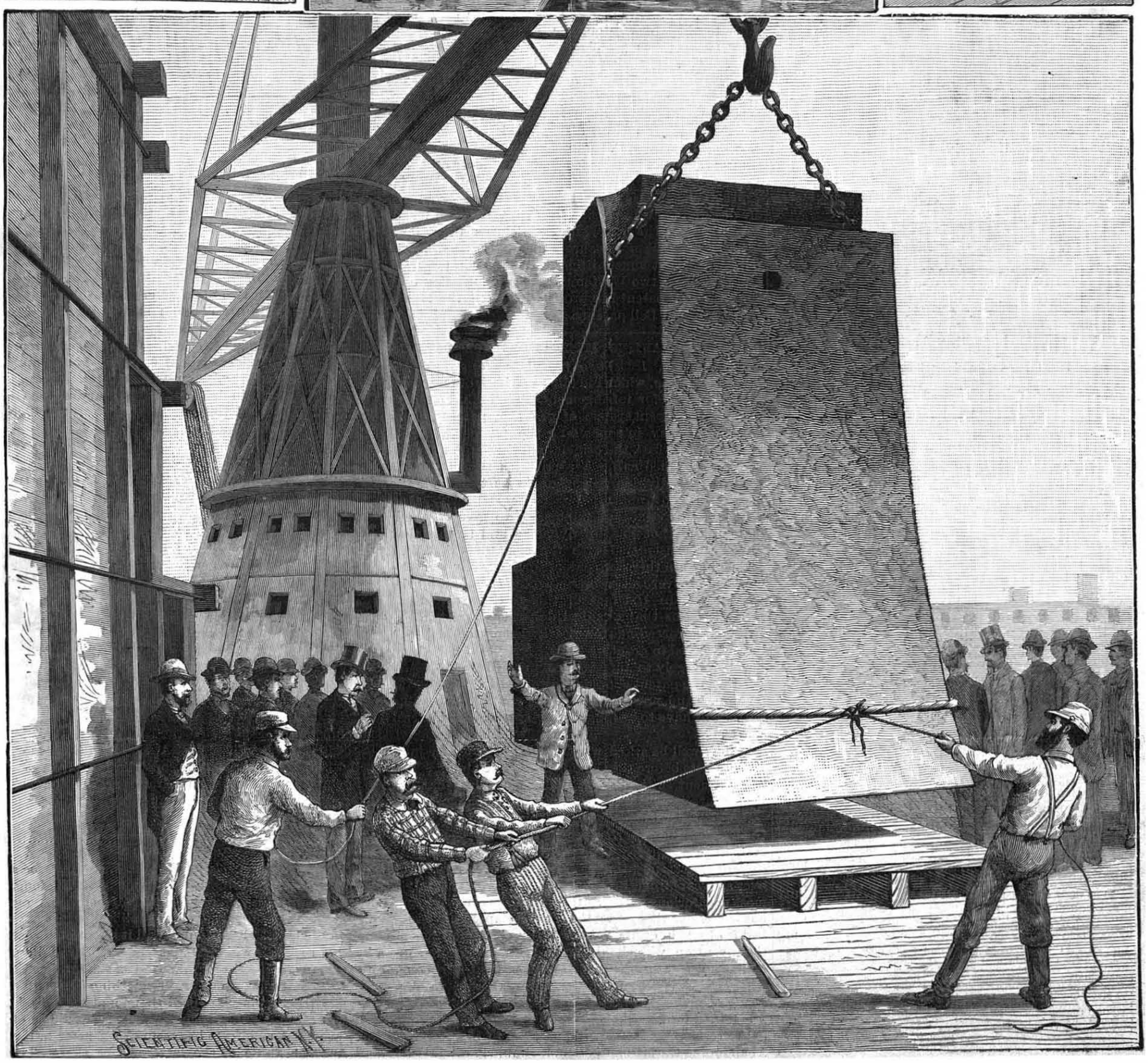
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LX.—No. 17. ESTABLISHED 1845. NEW YORK, APRIL 27, 1889. $3.00 A YEAR, WEEKLY.



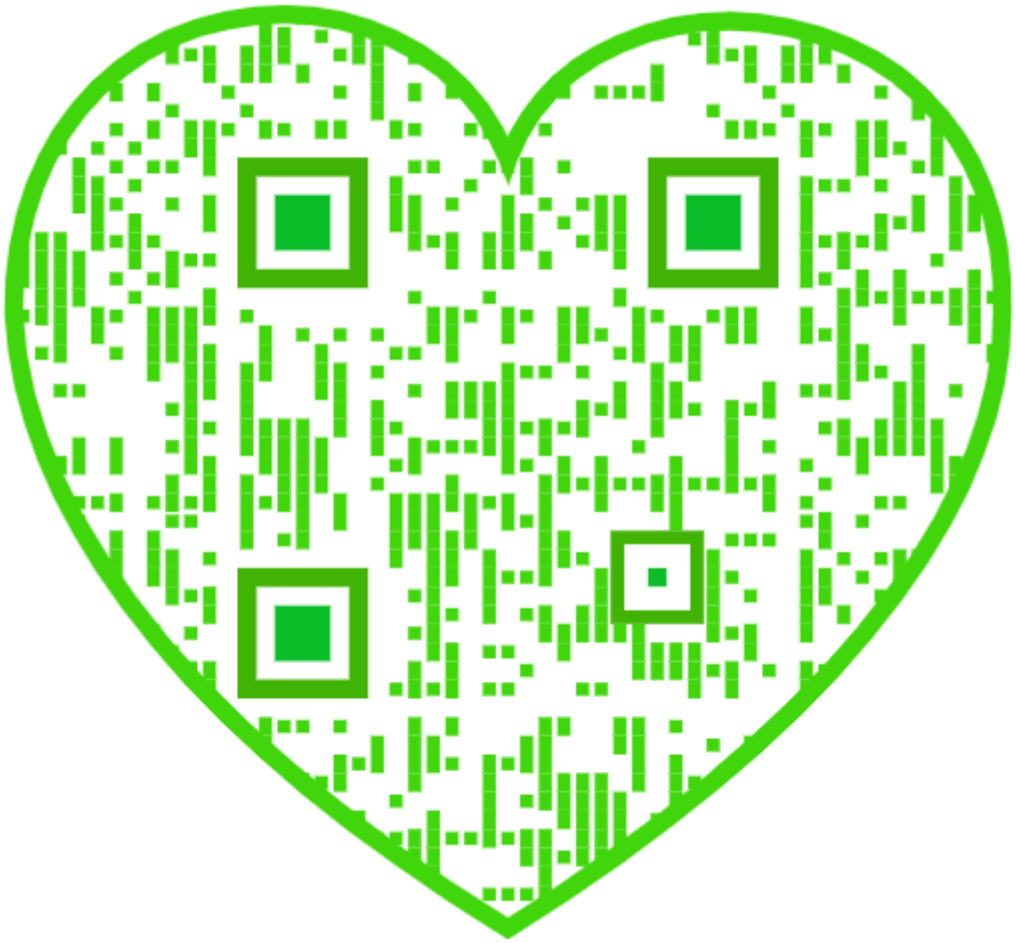






IMPROVEMENT OF THE RIVER FRONT OF NEW YORK CITY.—[See page 261.]

© 1889 SCIENTIFIC AMERICAN, INC



Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S. or Canada.....$3 00
One copy, six months, for the U. S. or Canada..... 1 50
One copy, one year, to any foreign country belonging to Postal Union, 4 00
Remit by postal or express money order.

Australia and New Zealand.—Those who desire to receive the SCIENTIFIC AMERICAN, for a little over one year, may remit $1 in current Colonial bank notes. Address
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for U. S. and Canada. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to any address in U. S. or Canada, on receipt of *seven dollars*.

The safest way to remit is by draft, postal order, express money order, or registered letter.

Australia and New Zealand.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for a little over one year on receipt of £2 current Colonial bank notes.

Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

NEW YORK, SATURDAY, APRIL 27, 1889.

Contents.

(Illustrated articles are marked with an asterisk.)

Age, electric..... 264
Block, building, Belden's*..... 259
Block, paving, Berrie*..... 258
Borers, to protect trees from..... 259
Burner, hydrocarbon, Meyers'*.. 260
Business and personal..... 265
Cascade, luminous..... 262
Conductor, lightning, Wood's*.. 259
Dredging sand and silt 262
Electricity, valve for..... 261
Explosion, locomotive*..... 262
Fastening, gate, Coffey's*..... 259
Firemen, new apparatus for 257
Foot, stove, Fowler's*..... 258
Forests, climatic influence of.... 263
Front, river, N. Y. City, improvement of*..... 255, 261
Fuel at Samoa..... 261
Hurricane, Samoan..... 260
Hydrate, hydrazine 259
Inventions, electrical..... 265
Inventions, index of 267
Inventions, mechanical..... 265
Inventions, metallurgical..... 265
Inventions, miscellaneous..... 265
Japanese as colporteurs 263
Magnetism, experiments in*.... 262
Matters, coloring, new..... 258
National Academy of Sciences.. 264
Notes and queries..... 265
Palms, twin, and ancient well of Los Angeles*..... 263
Pan, bake, Bicknell's*..... 260
Paraldehyde as a hypnotic..... 264
Paraldehyde habit..... 264
Patents, delay in granting 256
Patents, dynamo, suit under..... 256
Pipe, steel..... 263
Planets, position of, in May..... 256
Plow, snow, McCarthy & Moran's* 258
Salt beds in New South Wales... 256
Saturn, outer ring of..... 261
Siphon, jet, mercurial*..... 264
Sleep, normal..... 264
System, Julien..... 259
Telephones in Sweden..... 258
Thermometer, oven, Julier & Robinson's*..... 259
Tunnel, sub-river, Straub's*..... 258
Wax, sheet, to make..... 263
Wires, elec., aerial, in N. Y. city, removal..... 256
Works, locomotive, French..... 257
Young, Coe F. 263

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 695.

For the Week Ending April 27, 1889.

Price 10 cents. For sale by all newsdealers.

PAGE

I. AGRICULTURE.—The Loss of Nitrogen Caused by Working and Aerating the Soil.—A very curious and interesting point in agriculture investigated.—The results of cultivation without enrichment..... 11109

II. CHEMISTRY.—Nickel and Cobalt.—The result of recent researches upon nickel and cobalt, tending to show that they are not elemental bodies, but are compound.—Dr. Gruss and Dr. Russell's investigations..... 11110
The Separation of Oxygen from the Atmosphere.—By H. N. WARREN.—A method of concentrating oxygen gas from the air by diffusion through a rubber membrane.—1 illustration..... 11110

III. ELECTRICITY.—Arc Lamps and their Mechanism.—By Prof. SILVANUS P. THOMPSON.—The continuation of Prof. Thompson's exhaustive lecture on this subject, giving the details of construction of the prominent varieties of lamps.—15 illustrations..... 11104
The Discharge of a Leyden Jar.—By Prof. OLIVER J. LODGE.—A recent lecture, giving the popular exposition of the recent classic investigations upon the discharge of static electricity.—1 illustration..... 11102

IV. GEOLOGY.—Natural Gas in Louisville, Ky.—The Kentucky natural gas supply, the geological features of its distribution, and probabilities of its extensive development..... 11109

V. MECHANICAL ENGINEERING.—Composite Gearing.—By Prof. C. W. MACCORD, Sc.D.—A valuable contribution to the science, being the combination of involute and epicycloidal systems.—3 illustrations..... 11098
Paris Exposition—Elevators at the Eiffel Tower.—The different types of elevators to be used in the great Eiffel tower.—Comparisons of French and American methods, with full details of dimensions, etc.—9 illustrations..... 11099
Shaping Sheet Metal by Fluid Pressure.—A very simple and efficient means of forming concave sheet metal objects.—A substitute for the spinning process.—9 illustrations..... 11101
The Bernier Hot Air Engine.—A calorie engine in which the air producing the working pressure is forced through the body of fuel.—3 illustrations..... 11099

VI. MEDICINE AND HYGIENE.—New Treatment of Ataxia.—A new method of treatment of this affection of the spinal cord.—Treatment of paralysis by the suspension process.—4 illustrations 11095
On the Use of Tobacco.—By FRANK H. BOSWORTH, M.D.—A scientific review of the influence of tobacco on the human system, being a plea in favor of its moderate use..... 11096
Removal of Tattoo Marks.—Medical treatment of tattooing for its removal.—A simple and efficacious process described..... 11097
Traumatic Epilepsy Successfully Treated by Trephining.—By F. A. SOUTHAM.—The successful heroic treatment of epilepsy, with details of cases, their diagnosis and results..... 11097

VII. MISCELLANEOUS.—Candle Lamp.—By J. MARTIN.—A novel form of candlestick adapted to a curved candle.—1 illustration..... 11106
The "Sturmer" Chess Board and Magic Squares.—By EDWIN STURMER.—A curious method of designing an ornamental chess board by utilizing the knight moves for the ornamentation of individual squares, with examples of magic squares of numbers based on the same principle.—3 illustrations..... 11106

VIII. PHOTOGRAPHY.—"Platino-Uranotype," and "Mercuro-Uranotype," two New Uranium Printing Processes.—The two new processes, with formulas of interest to all photographers.—By Mr. ALLEYNE REYNOLDS..... 11102

IX. PHYSICS.—A Spectroscope with Fluid Prism.—By A. F. MULLER.—A simple form of spectroscope which can be constructed with the most ordinary appliances and simplest possible tools described in detail.—5 illustrations..... 11107
Galileo and the Microscope.—The probability that Galileo was the inventor of the microscope at the beginning of the 17th century..... 11108
Optical Phenomena of the Atmosphere.—The blue color of the rainbows, halos, and mock suns investigated, with experimental illustrations.—4 illustrations..... 11108
Polarized Light.—Three notes by Dr. S. P. THOMPSON on polarized light, of interest to all students of optics..... 11106

X. TECHNOLOGY.—Sulphuric Acid.—A review of the American sulphuric acid industry as well as of its development in Europe,..... 11101

REMOVAL OF AERIAL ELECTRIC WIRES IN NEW YORK.

The work of removing the aerial telegraph, telephone, and electric supply lines in this city, with a view to forcing the electrical supply companies to use the subway system in such streets as contain it, bas been vigorously prosecuted during the past week. An attempt, on the part of the Western Union Telegraph Co., to obtain an injunction in the Federal courts having failed, the city authorities put a large force of men at work to cut and remove the wires and lower the poles. Unfortunately, the work has been marred by casualties, one instant death and several injuries resulting. One lineman, who had climbed a pole, narrowly escaped with his life, as the rotten wood gave way, and the pole, unbraced by the usual telegraph lines, fell. It fortunately struck against a building, so that the operative was afforded a chance of escape, which he was quick to profit by. This accident showed that the poles were a distinct source of danger as they became more and more decayed.

A very impressive feature of the operations is the comparative darkness to which the city in these parts is relegated at night. The gas lamps are quite unable to supply sufficient light for the people, who have now been accustomed to electric illumination. It is to be hoped that the electric light companies will make every effort to start their lamps anew and give the many centennial visitors a good illustration of subway electric supply and illumination.

A NEW SUIT UNDER ELECTRIC DYNAMO CONSTRUCTION PATENTS.

The initial proceedings in a suit brought by the Westinghouse Electric Company, through its lessee, the United States Electric Light Company, against the Manhattan Electric Light Company, were taken on April 18. The suit, presumably the first of an extensive series, is notable from the patents under which it was brought. These are two patents granted within a few days to Edward Weston, the well known inventor, after nearly seven years' delay caused by interference proceedings. If they prove to be valid, they will be among the most valuable patents extant in the class of dynamo-electric machinery. The feature of construction covered by them is the building up of an armature core from iron disks with interposed plates of insulating material. Four carefully worded claims, undoubtedly the broader from the early date of application, when the field was unnarrowed by similar inventions, cover as far as can be seen the whole system of disk-built armatures. As the vast majority of armatures of the well known Siemens type, both for dynamos and motors, are thus constructed, it will be evident that much litigation may be in prospect, and that these two Weston patents may yet figure in the annals of patent law proceedings with the Morse, Goodyear, and Bell patents.

DELAY IN GRANTING APPLICATIONS FOR PATENTS.

On April 16, 1889, two patents were granted to Edward Weston, which bid fair to be basis of many and extensive suits for infringement. They illustrate the evils of the present system of granting patents, as regards the delay in concluding the proceedings. On September 22, 1882, the original application for this invention was filed as for a single structure, and eight weeks later a division was made so as to include the matter in two applications. This was nearly seven years ago. It would be impossible to give any estimate of the thousands of dynamos and motors that have been constructed with the armatures described and claimed in these two patents. Every day sees the factories all over this country turning them out by the wholesale. In the face of this testimony to their merit, it seems that a radical defect must exist in Patent Office proceedings for nearly seven years' delay to have occurred in granting them. Six years have been devoted largely to interference proceedings to settle whether the patent should be awarded to Edison or to Weston. And now, after all that contest, the same battle will have to be fought over again in the Federal courts.

It may well be asked what good is attained by judicial contests before the Commissioner of Patents. The infringement suits brought under a patent that has been contested under interference proceedings in the Patent Office are not accelerated by the contest before the examiners of interference. The Federal courts attach little weight to Patent Office decisions. As the present case stands, the patentee has been barred for over six years from bringing suit under apparently a most meritorious patent. It is true that the triumph has come, but the years that have elapsed have robbed it of much of its value. Many old time users of the invention, who should have been *prima facie* infringers, are out of the field. With present infringers, whose name is legion, if the patents prove valid, a battle of probably greater duration has to be fought.

It would be far simpler for the Patent Office to act in the registering faculty, rather than in the judicial. Abandoning the latter function, it should grant patents to any applicant, and let the battles of priority, like those of infringement, be fought in the Federal courts. This would be a move in the right direction, and in that of simplification. It would tend to make attorneys more careful in drawing up claims, and would multiply immensely the number of examiners, for every inventor personally would be his own examiner, and would search the records in order to waste neither time nor money in procuring a worthless patent, or else he would employ competent attorneys and experts to do the same for him.

POSITION OF THE PLANETS IN MAY.

VENUS

is morning star. She is a charming object in the eastern sky before sunrise, as she oscillates westward from the sun, rising earlier every morning and increasing in brilliancy as a larger portion of her illumined disk is turned toward the earth. Her rapid movement southward may be observed, her declination on the 1st being 19° 7′ north, and on the 31st 11° 33′ north. She rises on the 1st a half hour before the sun, and on the 31st about an hour and three-quarters before the sun. Venus rises on the 1st at 4 h. 28 m. A. M. On the 31st she rises at 2 h. 45 m. A. M. Her diameter on the 1st is 59″.6, and she is in the constellation Aries.

JUPITER

is morning star. There will be a fine opportunity for contrasting the two planets. Venus is the more brilliant, but her luster is dimmed by the radiance of the dawn, while Jupiter seems almost her equal in brightness as he shines with the midnight sky for a background. The regal planet is approaching the earth, and will be superb when, on the last week of the month, he looms above the southeastern horizon about 9 o'clock in the evening, and looks down from the meridian at 1 h. 47 m. A. M. Jupiter rises on the 1st at 11 h. 16 m. P. M. On the 31st he rises at 9 h. 9 m. P. M. His diameter on the 1st is 40″.6, and he is in the constellation Sagittarius.

SATURN

is evening star. He is in quadrature with the sun on the 3d, is then on the meridian about sunset, and finely situated for observation. He may be found in the west when it is dark enough for the stars to come out, slowly approaching Regulus in the handle of the Sickle, but his light grows dim as he approaches the sun. Saturn sets on the 1st at 1 h. 28 m. A. M. On the 31st he sets at 11 h. 34 m. P. M. His diameter on the 1st is 17″.2, and he is in the constellation Cancer.

MERCURY

is evening star. He reaches his greatest eastern elongation on the 24th, and is 22° 49′ east of the sun. He may be easily seen at that time, and for a week before and after, by the unaided eye. Observers will be sure to find him, for his position is most favorable. He sets on the 24th about two hours after the sun. Those who desire to find the shy planet must command a clear view of the northwestern horizon, and commence the search three-quarters of an hour after sunset. Mercury will not fail to appear about 5° north of the sunset point, as a bright star with an intense luster. An opera glass will be an aid in finding him. Mercury sets on the 1st at 7 h. 28 m. P. M. On the 31st he sets at 8 h. 57 m. P. M. His diameter on the 1st is 5″.2, and he is in the constellation Aries.

MARS

is evening star. As he moves westward from the sun he meets Mercury moving eastward. The planets are in conjunction on the 5th. Neptune overtakes and passes Mars on the 12th. Mars sets on the 1st at 7 h. 53 m. P. M. On the 31st he sets at 7 h. 40 m. P. M. His diameter on the 1st is 4″, and he is in the constellation Taurus.

NEPTUNE

is evening star until the 22d, and then morning star. He is in conjunction with the sun on the 22d, rising and setting with the sun, and passing to his western side. Neptune sets on the 1st at 8 h. 23 m. P. M. On the 31st he rises at 4 h. 9 m. A. M. His diameter on the 1st is 2″.5, and he is in the constellation Taurus.

URANUS

is evening star. He sets on the 1st at 4 h. 1 m. A. M. On the 31st he sets at 2 h. 2 m. A. M. His diameter on the 1st is 3″.8, and he is in the constellation Virgo.

Mercury, Mars, Saturn, and Uranus are evening stars at the close of the month. Venus, Jupiter, and Neptune are morning stars.

Salt Beds in New South Wales.

The Sydney *Daily Telegraph* says: What may be a discovery of great value has been made at Ellalong, near Maitland, and about 16 miles from Allandale station. There a deposit of crystallized salt, 4 feet thick in places, has been found, and it is expected that a body of rock salt will be reached below. Mr. Hilton, an expert, expresses the opinion that a similar deposit will be discovered at Ellalong. Something like 100,000 tons of salt per annum are used there, and the price is 5*l.* 10*s.* per ton. Thus, such a discovery would be of great value. A syndicate has secured 400 acres of the land, and the value of the latter will be thoroughly tested.

© 1889 SCIENTIFIC AMERICAN, INC

A French Locomotive Works.

[SPECIAL CORRESPONDENT OF THE SCIENTIFIC AMERICAN.]

LONDON, March 22, 1889.

Through the kindly interest of Mr. Bailly Blanchard, the U. S. Commissioner at the Paris Exhibition, I obtained letters of introduction from M. M. Coutauren to Mons. Kerournes, superintendent of the principal works of the Chemin de Fer du Nord, at Hellemmes, near Lille, and visited those works on my way home from Paris. I found there much of great interest, and am under obligations for the kindness with which I was received and the complete facilities afforded me in investigating the workshop methods.

I stated in my letter of January 17 that, so far as I could then see, French engineers had, like the English, failed to fully perceive the boon that American engineers had given to machinists in the milling machine and the emery wheel. This statement I must now modify to a certain extent, inasmuch as at the works in question I found more milling machines and fewer planing machines than I have ever seen in any other similar shop, not excluding the Baldwin Locomotive Works or the Pennsylvania works at Altoona, and larger milling machines than I have seen anywhere, save, perhaps, the large machine built by Bement & Miles, or that designed by Professor Sweet for the Straight Line Engine Works, at Syracuse, which, I learn, is going to be built and put on the market by the Pratt & Whitney Co., of Hartford, Ct. The French machines are, however, of a different construction, having a main frame much resembling that of a slotting machine, and in many cases a work table with feeds similar to that of a slotting machine—the only machine of this kind in the United States, as far as I know, being in the Bliss works, in Brooklyn, N. Y. In the works at Hellemmes, however, there is one machine that finishes all the work on a locomotive cylinder complete.

Now the fact of using milling machines in place of planing machines does not prove that it is economical to do so; and as the question of the relative economy of these two machines has been much discussed of late in the United States, I may say that, judging by the quantity of machinery in comparison to the amount of work being done in the shop, milling machines must be very much more economical than planing machines. Indeed, I was surprised to find the smallness of the machinery part as compared to the size of the works. It may be explained, however, that the wheel department was separate, and there were more machines in the erecting shop and boiler shop than is usual. But the main fact remains, viz., that the milling machine has displaced the planing machine here, and, to my mind, with very great advantage. There is, indeed, I believe, but one planing machine in the whole of the works.

I am inclined to believe that this type of machine (*i. e.*, with the slotting machine style of frame) is of French origin, and it will be interesting to ascertain (as I mean to do) how long it has been used in France, for I gather that the honor of having invented the milling machine is not entirely conceded to American machinists. But there are milling machines and milling machines, and I do not suppose that there is any well posted machinist who will dispute the fact that the Brown & Sharpe and Brainerd machines are unequaled, in their respective fields, by anything that has been produced on this side of the Atlantic, and that the fields they occupy are those that have made the reputation of the milling machine. But when it comes to the larger sizes of machines, the United States does not so clearly maintain its superiority; or at least that is the impression one receives after seeing the large machines at John Elder's, on the Clyde, and the machines at Hellemmes. Those who consider that a frame carrying a cone and live spindle for driving the cutters and a self-acting feed table with two notch plates for index wheels constitutes a complete milling machine claim the honor of its invention for England.

Whitworth made, years ago, a milling machine of the kind known in the United States as the Lincoln pattern, but whether he copied or was copied I have not as yet been able to determine. But there is one thing I do know, and that is that the Whitworth Co. do not thoroughly understand the modern milling machine, or they would not make the style of nut milling machine they do, with its two separate heads with removable tools in them. There is in the S. E. R. works at Ashford, Kent, a milling machine with a box frame carrying a live spindle with convenience for mills or cutters at each end and a self-acting feed for both. How old this machine is I do not know, but it has been at work since 1849, to my knowledge, but on nuts only, and has none of the spiral feed motions or other fixtures that are the life of the American milling machine.

Most of the lathes at Hellemmes are of French make, but made by an Englishman, and while solid enough, possess some very awkward features, which will be pointed out at a future time.

Locomotive fireboxes are here made of copper, and the firebox stays are also of copper. In cutting the threads on these stays the pitch was found to alter, it was stated to me, on account of their getting warm from the cutting operation; but this I believe to be an error, and that the causes in such cases are due to the longitudinal strain caused by cutting the thread. The machine used for this purpose possesses a peculiar feature, which I only remember to have seen once before applied to a screw-cutting machine, and that many years ago, the principle being as follows: The work-driving part of the machine corresponds to a lathe head, and the dies are carried in a sliding head taking the place of a lathe tailstock. On the live spindle, in place of a live center, is a long hob, corresponding to those used on an American Fox lathe and having a similar guide arm, which is attached to the die head, so that the hob acts as a lead screw, forcing the die head to travel at the right speed for the pitch of thread being cut. There is no doubt that a device of this kind is necessary whenever long screws or square-threaded ones are to be cut.

A blunder is committed in this machine that has been very thoroughly exposed in the United States, and that there does not seem much excuse for, considering the attention that has been called to it in the past. I refer to the putting of three chasers in the head instead of four. As this machine is of English make, however, it is not fair to charge French practice with its errors. Curiously enough, the taps have four plates, but the company make their own taps, and, indeed, have their own thread, there being no standard in France.

One or two things with reference to the lathe work struck me as remarkable. For example, I saw no universal chucks, the chuck plates having round holes in them, into which fitted movable dogs. One or two lathes had turret heads, with the usual complement of tools, but there were no stop motions to them, and as a result the workman went on measuring for each cut just as he would have to do without the turret, which, I may observe, was placed on the top of the slide rest. I saw the same thing done in an English shop, and so suppose it is a regular thing here, but do not see why so much of the advantage of the turret should be lost for the mere want of a stop motion.

My curiosity was aroused to find on the smaller lathes, say up to 24 inch swing, long-handled hand tools, and I waited some time to see what they were used for. At last I found that, to take the finishing cut, these hand tools were used in connection with the automatic feed of the lathe, being merely held in the hand and resting on the roughing tool while fed automatically, the idea being, no doubt, to save taking out the roughing tool to resharpen it for every finishing cut. I am bound to say that, so far as I could see without examining the work, the men seemed to get along very well this way, but I have no hesitation in saying that it is not a commendable practice, as more parallel and true work will certainly be got by a rigidly held slide rest tool.

I have stated that most of the lathes were of English pattern, but there was one of the large lathes with raised V's after the American pattern, which, like a good many other things, is claimed here as an old English and discarded style. All the screw-cutting lathes had a ratchet feed and release arrangement for use in regulating the depth of cut and withdrawing the tool on the back traverse, such a device having been illustrated in the SCIENTIFIC AMERICAN in 1877, having been found on a lathe at the Rogers Locomotive Works, in Paterson, N. J.

Emery grinding machines are used for the mills and cutters, these machines having been designed at the works. The tools look well sharpened, and were evidently hardened right out, and not lowered in temper at all. They had evidently, however, been quenched in oil, for if quenched in water they would have been whiter. The cutter grinding machine is not as well designed as similar machines are in the United States, and yet, from the number of large milling machines, and the variety of work they were applied to, the works will compare favorably with any other works I have yet seen anywhere. The new machines that are to be exhibited at the International Exhibition I am not to describe at present, but I can say that one of them applies the emery wheel in a way that is, I believe, original, and that is certainly good.

In the wheel shop I noticed a lathe that, while it drove the axle from the middle, as is done in the axle lathes of the Niles Tool Works and of Wm. Sellers & Co., yet had no tail stocks or dead centers; but the work was steady, nevertheless, and cuts of one-half inch deep were being taken off. Two men, one on each end of the axle, were working at this lathe. I also noticed that in turning up the journals of axles that had the wheels on, a split pulley was put on the axle to drive it by, so that both lathe centers were dead centers, and the truth of the journals was, therefore, independent of the truth of the live center of the lathe, and this is an excellent idea.

A machine for grinding up guide bars was constructed to use what may be called cupped emery wheels (corresponding in shape to those in use in some of the planer knife grinding machines in the United States). Wooden wheels, covered with coarse emery, were used, but I do not think this machine anything like equal to the American style, where the bars or work rests on the face of a table through a groove in which the perimeter of the emery wheel projects to an amount equal to the depth of the cut, and the bar is merely slid along the table over the wheel, because when, as in the French machine, there is a feeding mechanism to the machine, there is a want of solidity and a chance for lost motion.

The drilling machines call for no especial notice, except one that was used to drill ¼ inch holes through copper stays about 6½ inches long. The machine was belted to run about 800 revolutions per minute on what may be called the Sellers system, the belt passing over guide pulleys to a pulley fast on the drill spindle, thus getting the requisite speed without the use of gearing; and this is undoubtedly the best way to drive a drill, when it can be done, or in other words, to drive drills of moderate diameters. The stem of the drill passed through the somewhat flattened end of a pipe conveying the soap water, which passed down the stem of the drill to the cutting end, which was about $\frac{1}{16}$ inch larger than the drill stem and shaped like a very keen twist drill, the twist end not being over ¼ inch long. The feed was given both by hand and foot at the same time, and it took, on an average, 70 seconds to drill one stay, which I call good work.

Another machine worth calling attention to was one for truing up the sliding faces of axle boxes, which was done by a cupped emery wheel similar to that described with reference to the guide bar grinding machine. This, however, I think a more desirable form of machine for its purpose. The emery used on these two machines was very coarse—about as large, say, as No. 6 gun shot, or perhaps larger.

An item of much interest on the emery grinding machines was the means of lubricating the journals, which was as follows: A soft yellow grease was used, in a closed cup, the end of a screw abutting against the grease, so that when you gave the screw a turn it forced the grease by main pressure upon the journal. This is said to work excellently well, and I was informed that it was proposed to try a similar device upon the axle boxes of a locomotive. I should think it likely that such an axle box would, however, require a more continuous supply of lubricant than this would give.

I did not see a parallel vise throughout the whole shop, and although I am not an advocate for that class of vise for heavy work, still they are very handy indeed for medium sized work.

In the boiler shop I found them using Kennedy's (American) spiral punches, and using rope belts for drilling in any position on the boilers and for tapping stay holes, etc., these arrangements being very complete.

Taking these shops as a whole, they compare favorably with either American or English shops, and are well worthy of a visit. JOSHUA ROSE.

To Protect Trees from Borers.

Last year, says the *Rural New-Yorker*, we briefly alluded to the simple method employed by our neighbor Augustus J. Hewlett, to protect his apple and peach trees against the borer. It has led to so many inquiries that it may be well perhaps to speak of the method more in detail. Fruit growers all know that tarred paper about the trunk is harmful to it. Laths, etc., tied about the trunks are not altogether satisfactory. Mr. Hewlett's mode reduces the labor and expense to a minimum and seems thoroughly efficacious, as he has practiced it for over 20 years. White lead and raw linseed are mixed as for ordinary outside painting, though a somewhat smaller proportion of the lead suffices. With this mix enough cheap mineral paint and lamp black to imitate closely the color of the bark. The young trees should be painted in the spring just as soon as transplanted and every year thereafter in early May. The paint is applied from a little below the soil to a foot above. In four or five years the bark will peel off after the paint has been applied. When this excoriation occurs, if before July, it is best to remove what bark still clings and at once give another coating of the paint. The new bark underneath will be found bright and healthy, showing that the paint does no harm. Mr. Hewlett painted some apple trees every spring for 15 years or more. The painting was discontinued for several years, as he thought there might be no occasion for further painting. These trees, however, were at once attacked by borers, and several were found six inches above the entrance. Peach trees are painted in the same way. He has never had a tree injured by borers if they were regularly painted.

The editor of the *Rural New-Yorker* adds that Mr. Hewlett is a careful, conservative farmer and his statements may be accepted as fully trustworthy.

A New Apparatus for Firemen.

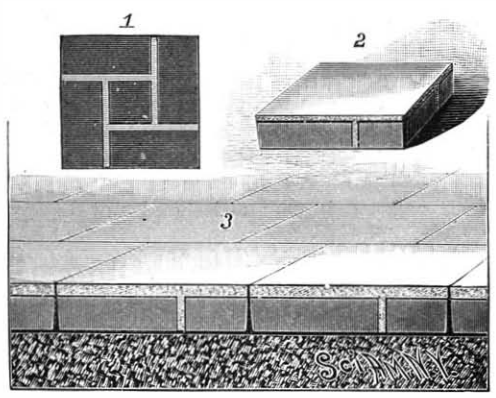
From April 1, 1889, Paris firemen will be provided with cylinders of oxygen under pressure, to be used for the prompt relief of persons suffocated during fires. The oxygen will be added to the regular supply of medicines always at hand in case of accidents.

© 1889 SCIENTIFIC AMERICAN, INC

THE BERRIE PAVING BLOCK.

A cheap, simple, durable, and easily made paving, which can be economically manufactured in connection with brick yards, is shown in the accompanying illustrations. It forms the subject of a patent issued to Mr. Robert B. Berrie, of Lexington, Mo. The blocks consist of common rough hard-burned brick, and are 12 inches or one and one-half bricks square, and are placed in moulds, so as to admit of the bricks being cemented together with any good cement, applied as shown by the illustrations. These blocks are brought to a smooth surface on top side with any desired thickness of cement, by troweling with steel trowel, using a little dry cement to give a hard glazed finish.

The advantages claimed for this pavement are that it



THE BERRIE PAVING BLOCK

is cheap and strong and will not be injured by the action of frost or changes of the weather. The blocks are so constructed as to allow for any expansion caused by the frost on the bottom side. They will withstand a much greater strain or jar without breaking on account of the hardness of the brick for a body, and the cement being thoroughly keyed between the brick, forming a solid block of hard brick and cement.

This pavement is being manufactured and put into practical use, and is said to give satisfaction. For further particulars and references address R. B. Berrie, Lexington, Mo.

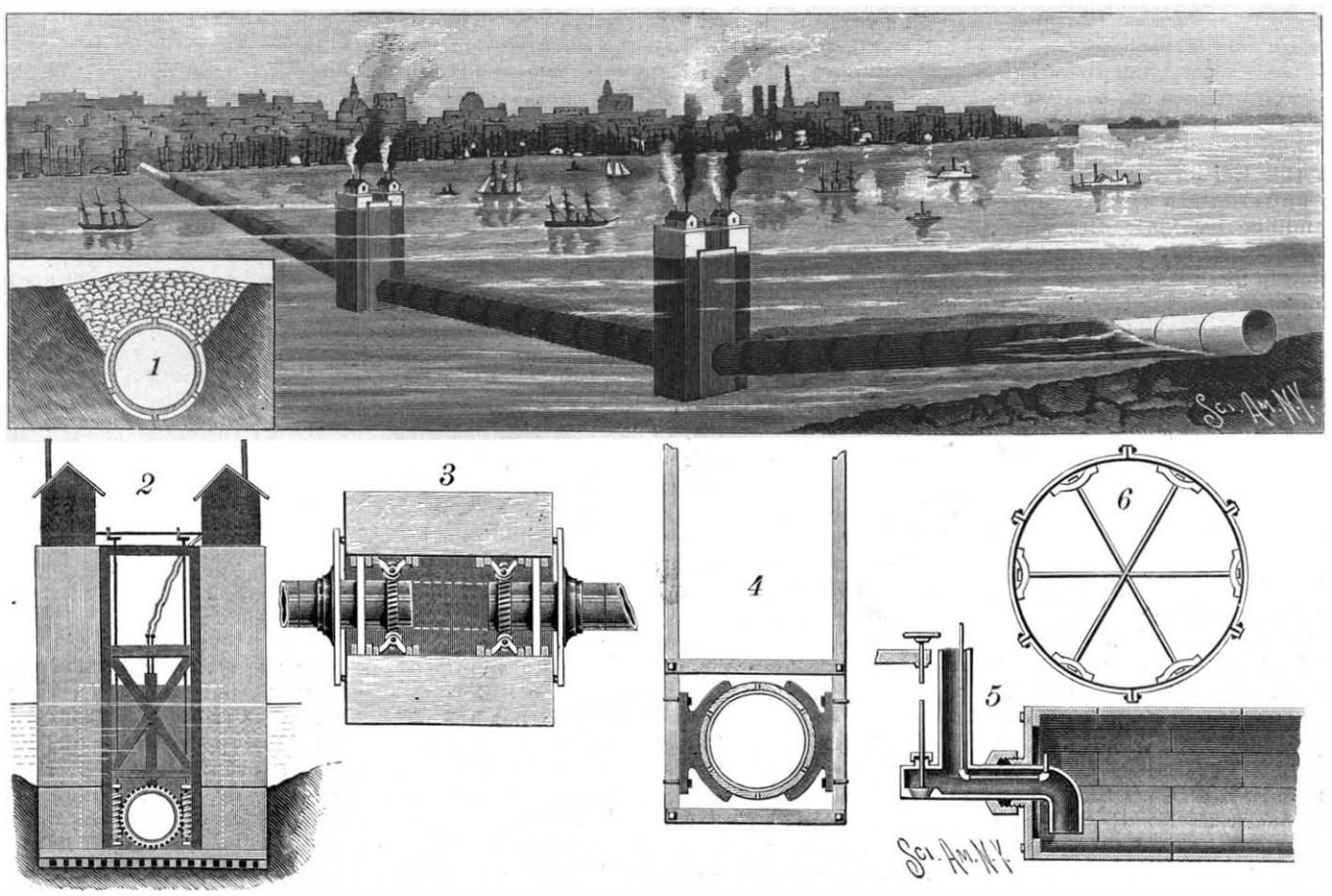
STRAUB'S PLAN FOR A SUB-RIVER TUNNEL.

The accompanying illustration represents a novel form of sub-river tunnel, more especially designed for use in the Hudson and East Rivers, at New York City, and which forms the subject of a patent recently issued to Mr. A. W. Straub, of No. 22 South Thirty-seventh Street, Philadelphia, Pa. It is proposed to construct such tunnel of several long sections of steel tubes, about eighteen feet in diameter, with heavy strengthening flanges passing around the tubes at intervals of five or six feet, while there are also ribs running lengthwise of the tube. These tube sections are to be constructed above ground and lowered into a prepared line of way previously dredged or otherwise made in the river bottom. Fig. 1 shows a cross section of such tunnel in position, with its top weighted by stone and cement covering, to hold it firmly in position, this covering extending about five feet over the tunnel and down its sides. Fig. 6 shows a cross section of the tunnel with removable cross-rods therein for bracing the sections while being conveyed and sunk to the river bottom. The tunnel is preferably constructed with two extended lengths or sections constituting the bank or shore approaches, which, when placed in position, have a downward grade, and are connected with the intermediate or central sections by short sections, these connections being accomplished within removable caissons built in the river around the adjacent ends of the shore and central sections. These caissons are arranged at right angles to the line of the tunnel, Fig. 3 being a plan of the meeting terminals of a central and a shore section, and Fig. 2 being a sectional view of a caisson with its upwardly extending columns, upon which are located the engines required for pumping out the tubes, lowering them into position, etc. Fig. 5 shows a longitudinal section of one of the tunnel sections with its removable ends or heads and the air and water pipes therefor, while Fig. 4 shows part of the bearing frame for the tunnel section within the caisson.

The temporary piers or caissons to retain the tube at its proper location over the trench previously dredged to within a few feet of its future location are formed of two great boxes, some 50 feet square and 70 feet in height, standing upon a strong platform of timber, 50 feet wide and 130 feet long, leaving a space of 30 feet between the boxes or piers. They are filled with stone and anchored in their proper location, when the tube is floated, with its ends between these boxes, which sustain it over the trench. A framework with a journal bearing in it is then built around the end of the tube, which is fitted into guides, which carry the tube down plumb to the desired depth. A gear wheel is placed on the end of the tube, meshing into two worm wheels, to revolve the tube while sinking into a perfect foundation, thus fitting itself to place from end to end. The frame when down forms a water-tight gate against the two boxes and the platform in the bottom. In order to pump water into the tube and still permit it to revolve, it is necessary to carry the pipe through the bulkhead in the center, through a stuffing box.

After a section is sunk on each side of the piers, and the frames or gates are down, they form a water-tight basin between the gates and the piers above the platform. The end of a section will extend through each gate. After the water has been pumped out of this caisson, a short section of tube can be built within the caisson to unite the long sections. After all are united, dredge the silt from the top and sides of the tube and anchor it to the river bottom with a saddle of broken stone and cement, which will retain the tube round the bulkheads and stay rods are removed, and prevent it from floating when the water is pumped out.

After the tube has been laid and anchored, the stone can be removed from the boxes, when they will float away, leaving the platform remaining beneath the tube.



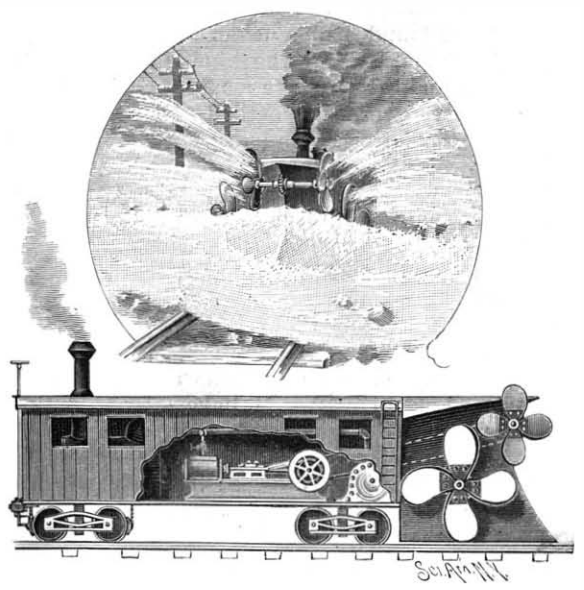
STRAUB'S PLAN FOR A SUB-RIVER TUNNEL.

Telephones in Sweden.

In probably no country in the world has the telephone come into more general use than in Sweden. Not only can Stockholm boast the most perfect telephonic arrangements of any capital, in addition to the largest percentage of telephone subscribers, but the east coast and the west coast will soon be in telephonic communication, a line between Stockholm and Gothenburg being in course of erection. Many small towns are in telephonic communication with each other, and the number of subscribers is constantly increasing. In Malmo, for instance, which has about 40,000 inhabitants, there are six hundred subscribers; this town is connected with about thirty smaller towns and country places, with subscribers ranging between two hundred and ten. In Norway also there are several new lines in course of construction.

AN IMPROVED RAILROAD SNOW PLOW.

The plow herewith shown has been patented by Messrs. Charles A. McCarthy and John P. Moran, of Sault de Ste. Marie, Mich. It has at its forward end a nose, consisting of steel plates arranged to form essentially a triangle, the forward end of which is concaved from top to bottom. Within the sides of the nose, at or near the center, two shafts are journaled, each having at its outer end a hub, to which spaced twisted arms are rigidly secured, projecting from the hub. The hub and arms are preferably made of steel, and the blades are given a pitch best adapted to the angle at which the snow is to be thrown. Within the body is a boiler to supply steam to three engines, two of which are rotary, and placed at the forward end, one on each side, while the third engine is a horizontal one, and placed in the center of the body, just in front of the boiler. The two side snow wheels are each rotated from a separate engine, while the horizontal engine operates an upper set of snow wheels, located one on each side above the center of the nose. As this plow is pushed through the drift by the engine of the train, or an engine employed to push the plow, the cutting edge of its nose divides the snow, and the several wheels, which are to be driven at the rate of two hundred or more revolutions a minute, blow the light snow to each side of the track, while if the snow be hard it will be thrown to a greater distance away.



McCARTHY & MORAN'S SNOW PLOW.

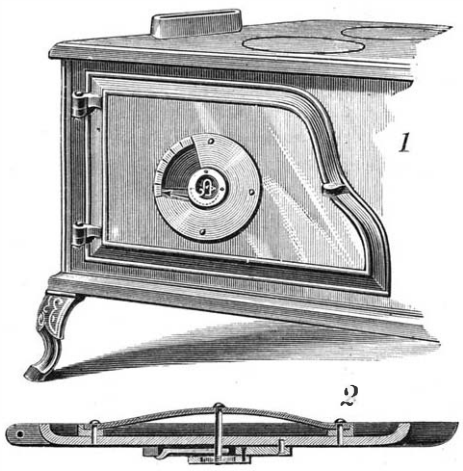
New Coloring Matters.

Primuline when diazotized and combined with an alkaline solution of β-naphthol forms a red coloring matter. Hitherto this could not be applied directly for dyeing or printing purposes on account of its insolubility. The present invention consists in dissolving primuline in water, acidifying the solution, diazotizing it with nitrous acid, and pouring the mixture into an alkaline solution of β-naphthol. The insoluble coloring matter is then filtered, washed, pressed and dried, and rendered soluble by heating it (in a closed vessel or in one connected with an inverted condenser) with about 2½ times its weight of sodium bisulphite of 50° Tw. to 100° C. The filtered solution is treated with salt, which precipitates the new product in the form of a yellow powder, which is very easily soluble in water and is decomposed by caustic alkali, with the formation of the above red coloring matter. If the coloring matter be used for printing and afterward developed by steaming, a red color is produced. Similarly, maroons and oranges can be produced by substituting α-naphthol and resoreinol for the β-naphthol.—*C. Dreyfus, Manchester.*

© 1889 SCIENTIFIC AMERICAN, INC

AN IMPROVED OVEN THERMOMETER.

A device to be applied to the oven doors of cooking stoves, etc., to indicate the exact heat of the oven for baking purposes, and also applicable to other stoves, hot air furnaces, and ranges, is illustrated herewith, and has been patented by Camilla Julier and James O. Robinson, of Hanging Rock, Ohio. Upon the inside



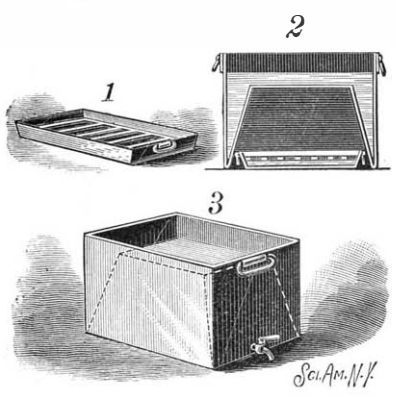
JULIER & ROBINSON'S OVEN THERMOMETER.

of the door is attached a hammered brass or other strip of more expansible metal than the cast iron of which the door is made, this strip being attached to the door at its ends, as shown in the sectional view. Secured centrally to the strip is a stem fitted to slide through an aperture in the door, and having an inclined projection or nose on its outer end. In engagement with this nose is an index pivoted to the door, the index being extended to travel over a graduated dial, and thus indicate the degrees of heat within the oven.

For further information relative to this invention address Messrs. Henry Miller & Co., Hanging Rock, Ohio.

AN IMPROVED BAKE PAN.

A pan especially intended for use in baking or roasting meats, fowls, etc., and designed to obviate the necessity of boiling before baking, thus retaining all the juices and flavors of the articles being cooked, is illustrated herewith, and has been patented by Miss Bettie H. Bicknell, of Loudon, Tenn. Fig. 1 shows the pan, and Fig. 2 is a sectional view of the pan and its cover in position for use, while Fig. 3 is a perspective view of the cover. The pan is of ordinary construction, and supports a rack, beneath which water may be placed.

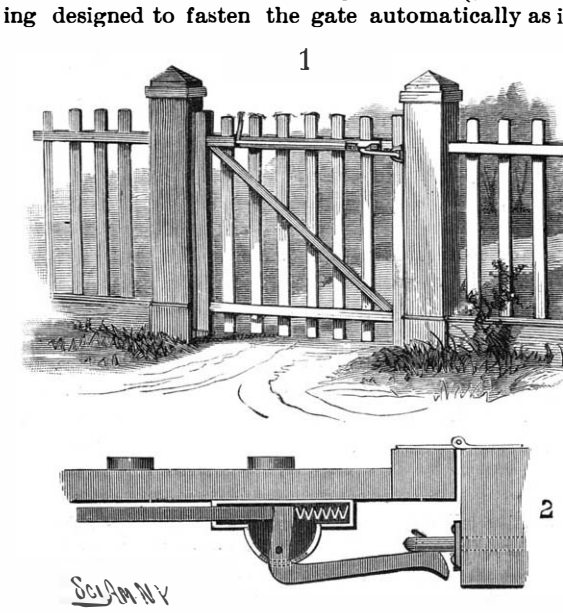


MISS BICKNELL'S BAKE PAN.

The cover is a deep inverted pan or box, preferably tapered toward its upper part, an outside band or upright box forming, with the inner portion, a surrounding water space, as shown in the sectional view. In this way the article to be cooked in the pan is practically inclosed by water. In one end of this water-holding cover is a faucet, for the purpose of drawing off the hot water when the pan is to be removed from the stove, thus making the pan lighter and easier to be handled, and lessening the danger of scalding the user. For further information relative to this invention address Messrs. Chambers & McQueen, Loudon, Tenn.

AN IMPROVED GATE FASTENING.

The illustration herewith represents a gate fastening designed to fasten the gate automatically as it is closed, and which, when the latch and catch are once properly adjusted, cannot get out of position so long as the gate remains on its hinges, no matter how much the gate sags or the weather affects the posts. It has been patented by Mr. Burton B. Coffey, of St. Joseph, Mo. The fastening device is usually secured on the inner side against the upper rail of the gate, Fig. 2 being a plan view thereof. It consists of a lever pivoted in a slot in a housing, the short arm of the lever extending into the housing from an elbow, while on the long arm of the lever is a catch adapted to engage a loop or staple on the post to which the gate is hinged. A spring in the housing presses against the short arm of the lever, tending to keep the catch in engagement with the staple. A short hand lever is pivotally connected with the upper rail near the outer end of the gate, the lower end of this lever being connected to a rod extending into the housing, in position to engage the short arm of the lever pivoted therein, and press it back to release the catch. Thus the gate may be released from the fastening by a movement of the hand lever, and on closing the gate it is automatically fastened by the catch coming into engagement with the staple.



COFFEY'S GATE FASTENING.

Hydrazine Hydrate.

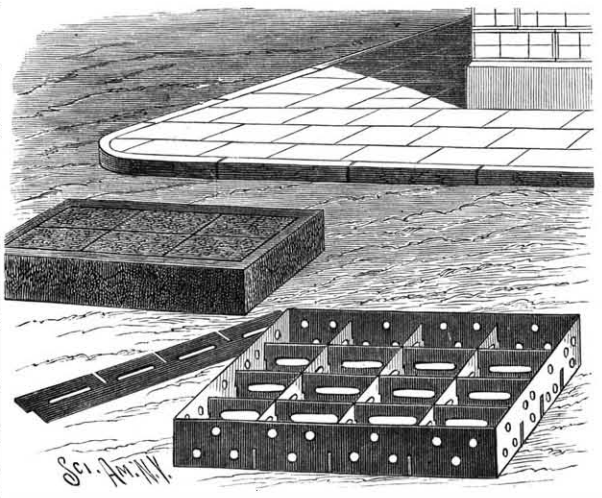
A substance which *Nature* terms one of the most remarkable liquids yet discovered, and which possesses properties that may render it serviceable in photographic processes, has recently been prepared by Drs. Curtius and Jay, of the University of Erlangen. Some two years ago the former investigator succeeded in isolating gaseous amidogen; but the free gas possesses such an affinity for water that its isolation in quantity seems impossible, water being of necessity a secondary product in all known reactions for producing this gas. But a pure hydrate of the substance—described as hydrazine hydrate—has been produced, and it is this liquid which possesses the remarkable properties alluded to. Says the *British Journal:* It is, of course, early to prognosticate as to the part it may play in the chemistry of the future, but the property we desire to draw attention to is its reducing power, which is evidently far beyond that of any of the substances at present utilized for photographic purposes—pyrogallol, hydroquinone, iron salts, etc. Hydrazine hydrate is probably the most powerful reducing agent known. The most easily reducible metals are precipitated by it from their solutions in the cold. Silver separates from strong solutions in fine compact crystalline masses, and from very dilute solutions in the form of perfect mirrors of great beauty. Neutral platinic chloride solutions are also similarly reduced, while acid solutions of iron, copper, and platinum are reduced from the ferric to the ferrous state, and so on. It remains to be seen if it can be utilized as a developer. In its concentrated form it acts on glass, cork, etc., so there are certainly practical difficulties in the way; whether they would be overcome by dilution, we are not able to say.

AN IMPROVED LIGHTNING CONDUCTOR FOR FENCES.

Wire fences are often a source of danger to cattle during electric storms, the wires being usually practically insulated from the ground, and liable to discharge a current through the body of an animal standing close to the fence. To overcome this danger is the object of the invention herewith illustrated, which has been patented by Mr. Fremont E. Wood, of Yucca, Arizona Ter. For this purpose a grounded rod, to the upper section of which is connected a point, is inserted at such intervals as may be deemed necessary in the fence, such rods being connected with the fence wires by an arrester of novel construction, shown in the sectional view. Its lower portion consists of a clamping socket, with a central longitudinal groove, upon either side of which are ribs, and in connection therewith is employed an upper socket section, the two sections having centrally apertured and internally threaded bosses to engage the grounded rod. A binding wire is bound within the threads of the rod and about the fence wire, the binding wire being so bound that the sockets may be moved to cross the fence wire diagonally. The socket sections are brought together and united by screws, the binding wire being forced hard against the fence wires, and the grounded rods by set screws. In applying this arrester, great care should be taken to secure proper connection between all the parts.

AN IMPROVED BUILDING BLOCK.

A substitute for bricks, natural and artificial stone, etc., for houses, bridges, street pavements, and a great variety of works of masonry, with the method of making such substitute, form the subject of a patent issued to Mr. B. W. Belden, of St. Louis, Mo. In the making of these building blocks, a portable frame or mould is used, as shown in the illustration, such mould having any desired number of sections or compartments, formed by partitions, provided with apertures so arranged as to establish free communication between the various divisions of the frame. This frame may be of wood, metal, straw board, or other suitable substance, but is preferably of non-corrosive metal, as galvanized iron, and the whole structure, including its outer shell, ribs, and partitions, may be of any desired shape and size. This frame is then filled with hydraulic cement, paper pulp, clay, or other suitable plastic composition, which, hardening in the frame, forms a solid concrete mass, in which the framework is thoroughly embedded. This building block is designed to afford superior strength, durability, solidity, facility of making and operating, beauty of finish and economy in cost.

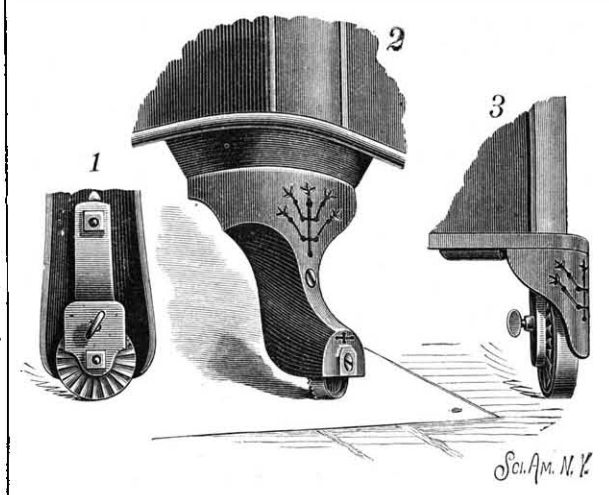


BELDEN'S FRAME FOR BUILDING BLOCKS, ETC.

For further particulars with reference to this invention address the Solidura Building and Paving Company, No. 6 North Second Street, St. Louis, Mo.

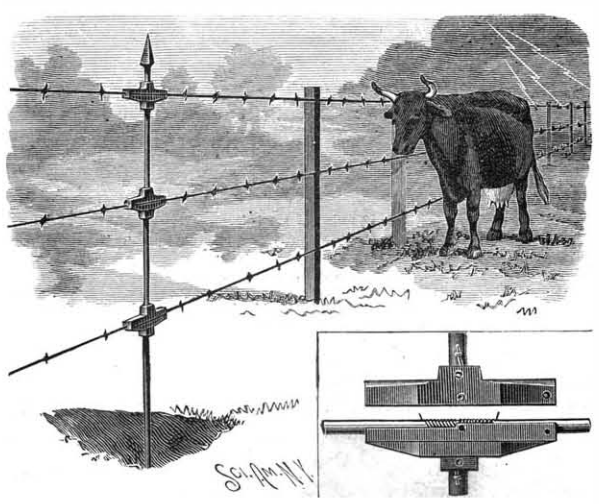
AN IMPROVED ROLLER STOVE FOOT.

A stove foot designed to promote the convenience of housekeepers when taking up and putting down carpets, oilcloths, etc., is shown herewith, and has been patented by Mr. J. Fowler, Alliance, Ohio. The stove leg is made with two downwardly extending arms, in which a roller works. This roller has on one or both faces a number of teeth, and a thumbscrew is screwed into the upper portion of the leg, adapted to engage the teeth on the roller, to prevent it from turning or allowing the stove to move from its position when the grate is being shaken. The upper portion of the leg is cast to form an arm, by means of which it may be secured to the bottom of the stove, and the improvement is applicable to long or short legs. With this device, a piece of zinc may be readily placed under a stove, and the stove can be easily moved when desired, by loosening the thumbscrews, which are screwed tight in ordinary use.



FOWLER'S STOVE FOOT.

THE Harlem Railroad have ordered of the John Stevenson Company thirty cars for the Julien storage battery system, to be used on the Fourth and Madison Avenue line in this city. These cars are to embrace a number of new features, and promise to be both elegant and comfortable. The Harlem Railroad Company have already a few electric cars in use on the same thoroughfare.

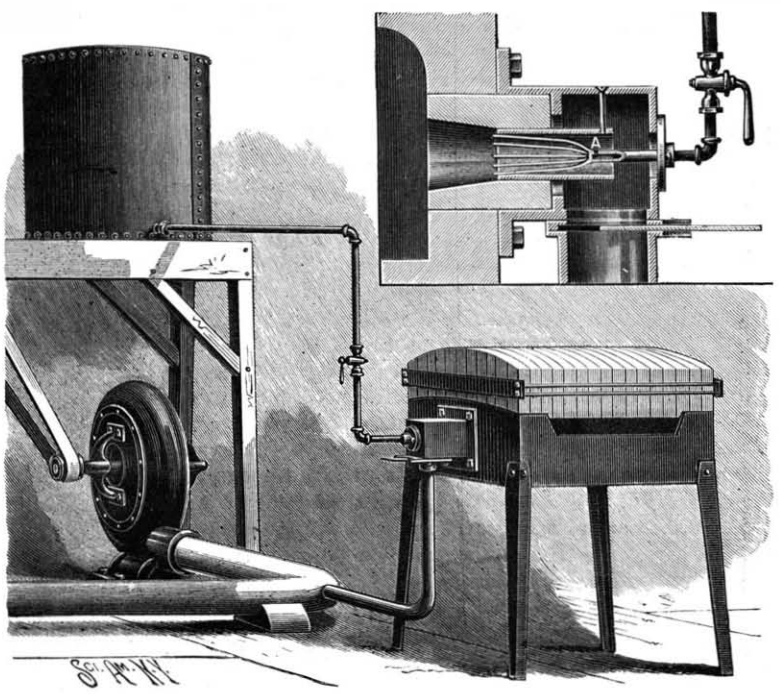


WOOD'S LIGHTNING CONDUCTOR FOR WIRE FENCES.

© 1889 SCIENTIFIC AMERICAN, INC

AN IMPROVED HYDROCARBON BURNER.

The illustration herewith represents a simple and very efficient form of burner, with which a most perfect combustion can be obtained, and the heat held uniform for an unlimited period. It bas been patented by Mr. Frank B. Meyers, of Fort Plain, N. Y. The burner is provided with a casing to the front end of which is secured a tube with bell-sbaped mouth, as shown in the sectional view, this tube usually passing through the mouth of the furnace in such manner that the wide end of the bell-shaped mouth is flush with the inside of the furnace wall. On the casing is a bushing through which passes the oil supply pipe, from any suitable reservoir, which may be a barrel or tank, this pipe baving a valve to regulate the flow of oil. On the inner end of the pipe are rods extending to the front end of the tube, these rods extending radially around the pipe, and in the inner end of the pipe is an opening, A, through which the oil is discbarged, the oil falling by its gravity around the inner ends of the rods. Into the side of the casing also opens a pipe, connected with a blower, there being in the casing an air supply regulator, by which the supply of air may be increased or diminished, the air passing over the ends of the rods and carrying the oil along them, so that the oil is completely atomized and the air charged with oil vapor, which burns in the bell-shaped mouth. The beat from the furnace also heats the bell-shaped mouth, the tube, and the rods, so that the atomizing of the oil proceeds very rapidly and the gas is highly heated before it is burned. These burners are made for all classes of work, from 6 × 8 inch fires for wire work and brazing to 5 × 24 foot furnaces for heating blooms. For further particulars with reference to this burner address Messrs. Meyers & Tanner, manufacturers, Fort Plain, N. Y.



MEYERS' HYDROCARBON BURNER.

The Samoan Hurricane.

One of the most violent and destructive hurricanes ever known in the South Pacific ocean passed over the Samoan Islands on the 15th, 16th, and 17th of March. As a result four war ships of the American and German navies were totally wrecked and two others badly damaged, while 142 officers and men lost their lives.

This little group of islands has attracted the attention of the world for some months past, and their political status is to be the subject of an international conference shortly to be held in Berlin, but the complications had become such that there were present in the harbor of Apia* at the time of the hurricane three American, three German, and one English men-of-war.

The harbor is a little semicircular bay on the northern side of the island of Upalu, the distance across the entrance to the bay being about three miles, mostly closed by a coral reef, but leaving a gateway of about three-fourths of a mile in which ships can enter. There is but a small space of deep water within which vessels can anchor, as there is a large shoal in the eastern part of the bay, and a coral reef in its western part, from 200 to 400 yards off shore, on which most of the vessels were wrecked, as the wind blew into the harbor from the open sea and forced them back against it.

The storm began on Friday afternoon, March 15, and by 11 o'clock at night the wind had increased to a gale, all the war ships keeping their engines working to relieve the strain upon their anchors. Rain began to fall at midnight, when, with the great waves rolling in from the ocean, the German ship Eber, and shortly afterward the American ship Vandalia, began to drag their anchors. By using full steam power they both managed for a while to keep off the reef, but by 3 o'clock the situation had become alarming, the wind blowing stronger and stronger, and the rain falling in torrents. Nearly every vessel in the harbor was by this time dragging its anchors, and there was imminent danger of collisions. On the shore the howling of the wind among the trees and houses and the crash of falling roofs aroused every one, and the storm was so violent that it was difficult to stand against it without some protection. Through the blackness of the night could be seen the lights of the men-of-war, moving slowly in different directions, indicating the manner in which they were dragging their anchors in the fierce currents of the little harbor.

A little after 5 o'clock day began to dawn, and revealed the full danger of the situation, the northeast wind working nearly all the vessels from their moorings in the direction of the reef, notwithstanding that the black smoke pouring from their funnels showed that desperate efforts were being made to keep them up against the wind. The decks were swarming with men clinging to masts and other objects and the hulls of the ships were tossing about like corks, one moment the vessels seeming almost to stand upon their beam ends, while the next instant the sterns would rise out of the water and expose to view the rudders and rapidly revolving propellers.

Several small sailing vessels had already gone ashore, and the Eber, Adler, and Nipsic were close together and only a few yards from the reef, the Trenton and Vandalia being farther from shore and almost obscured by the blinding spray. The gunboat Eber, as if making a last struggle to escape destruction, suddenly moved forward, but the current carried her prow against the port quarter of the Nipsic, after which she fouled with the Olga, though not seriously damaging either of these vessels. The Eber now seemed unable to make any further effort to save herself, and swung around broadside to the wind, drifting slowly toward the reef. A great wave, rolling in toward the shore, suddenly lifted the vessel high on its crest and carried her broadside upon the reef. She struck fairly upon her bottom, rolled over toward the open sea, and disappeared from view, apparently not a vestige of her being left. The breakers, however, hid a few struggling men, one officer and five men being rescued out of a total of 76 who were on board.

It was about 6 o'clock in the morning when the Eber was dashed upon the fatal reef, which the Adler was now fast approaching, about 200 yards west of the point where the Eber struck. She was approaching broadside on, and half an hour later was lifted on top of the reef and turned completely over on her side. The Adler did not, however, go to pieces, but was thrown so far up on the reef that when she turned over on her side nearly the entire hull was out of water. Of the 130 officers and men aboard, twenty were drowned or killed, but the rest were rescued, after exertions lasting throughout the day.

It was next the turn of the Nipsic. She was standing off the reef, but her three anchors were not holding, with all the steam it was possible to carry, and her men were preparing to hoist a heavy 8 inch rifled gun overboard to assist her anchors. At this moment the Olga, being unmanageable, bore down upon the Nipsic, knocking down her smokestack, and doing much other damage. After this the Nipsic was unable to keep up her steam power, and her captain seeing that further efforts were useless gave orders to beach the ship. This was done only with great difficulty, but the vessel, although badly damaged, has been hauled off since the storm, having lost but seven men.

At about 10 o'clock in the morning it was seen that a collision was inevitable between the Vandalia and the English steamer Calliope, both of which had been further out from the shore. Great waves were tossing the two vessels about, and they were coming closer together every minute, when suddenly the great iron prow of the British steamer, rising on the crest of an enormous wave, came down on the port quarter of the Vandalia, damaging the latter very much. The English vessel now, by getting up all possible steam, was able to work its way slowly out of the harbor to the open sea. She had powerful engines, and was capable of steaming sixteen knots an hour, but worked her way out against the wind at a rate of only about half a knot an hour.

It now became evident that the Vandalia could not be kept off the shore, her engines not being powerful enough to steam out to sea, and her anchors dragging so that she was fast approaching the reef upon which the 'Eber had first foundered. It was, therefore, determined to beach the vessel, her bow striking in the soft sand about a hundred yards off the shore and forty yards from the stern of the Nipsic, the vessel swinging around broadside to the beach. It was nearly eleven o'clock when the ship struck, and it was then thought the 230 men on board would be rescued without great difficulty. It was soon seen, however, that the vessel was filling with water, and settling down, while the seas continued to break over her furiously and the water to pour down her hatches. By noon the whole of the gun deck was under water, and the men were continually being knocked from their feet and thrown about so that many were badly injured. Most of them sought refuge in the rigging, but the wind seemed to increase in fury, and nearly every one had cast away most of his clothing. No boat could live for a moment in the surf, and it was impossible to get a line from the shore to the steamer, as there was no firing apparatus on the island. Officers and men were continually being wounded by being knocked about the deck, in many cases being washed overboard while senseless from such injuries. The entire afternoon afforded a continuous succession of such scenes of suffering and death, while the survivors were having their strength tested to the uttermost to sustain themselves in the precarious situations to which they still clung as hope seemed to be fast dying out.

In the meantime the Trenton, the American flagship, and the largest of the ships in the harbor, had succeeded in holding out against the storm, although at ten o'clock in the morning her rudder and propeller had been carried away by fouling with a piece of wreck, while water poured through the great hawse pipes on the berth deck until the firemen were up to their waists in water, and all the fires were extinguished. Such sail was set as could be carried, and reports affirm the most skillful seamanship in the management of the vessel. At one time, it is reported, her sailing master ordered every available man of the 450 constituting her crew into the rigging, that such a mass of men might partly act as a sail and also contribute, by their weight, to keep the vessel down on the side next the storm, and this novel experiment is said to have, for the time, saved the vessel from destruction. Soon, however, the vessel began to drift toward the Olga, and all expected that both vessels would at once go to the bottom. At this time the stars and stripes were seen flying from the gaff of the Trenton, the first time since the commencement of the storm that any flag had been raised. It seemed as if, certain of going down, her officers meant the Trenton to do so with colors flying. The captain of the Olga, however, slipped his anchors, and attempted to steam away, in doing which only a slight collision took place, when the Olga steamed to the mud flats in the eastern part of the harbor, where she was beached with but little damage to the vessel and no loss of life.

The Trenton was now fast approaching the shoal on which the Vandalia lay, and it seemed that the huge hull of the flagship would crush the Vandalia to pieces, and throw the one hundred men still clinging to the rigging into the water. It was after five o'clock, and the light was beginning to fade away, as the Trenton drifted slowly up to the Vandalia, the storm still raging with as much fury as at any time in the day. The men who had continued to cling to the rigging of the Vandalia were bruised and bleeding, and so near complete exhaustion that it was evident they could not hold out much longer. Suddenly those on shore heard the sound of cheering borne across the waters, the 450 voices of the crew of the flagship were cheering the luckless survivors on the Vandalia as the Trenton was closing up to her. But a faint reply was heard from the feeble and exhausted men, and immediately afterward the sound of music was heard. The band of the Trenton was playing the Star Spangled Banner. All who, on sea or shore, heard at this fateful time the strains of the American national anthem as they rose above the howling of the storm and the wild scene of death and destruction around, felt the inspiration of men capable of looking death bravely in the face, with the courage to battle determinedly to the end, whatever that end might be.

The collision of the two vessels, however, was so slight, as the Trenton gradually swung around broadside to the sunken ship, that it proved to be the salvation of the men in the rigging of the Vandalia, who could then jump readily to the deck of the Trenton, the latter now lying filled with water, and a total wreck, within a stone's throw of the American consulate, but holding together sufficiently during the remainder of the storm to afford a refuge for all who could reach her until they could be taken ashore.

All during the storm every effort was made by those on shore, at the little village of Apia, to render such assistance as was possible, and to care for the rescued. But the storm was so violent that, with the total absence of appliances for rescue, such assistance fell far below what all eagerly desired. The natives showed great bravery in dashing into the surf and imperiling their lives wherever a rescue seemed feasible; and all the recent differences caused by local wars and foreign diplomacy, which had originally brought the vessels

* For a review of the topography of the islands and some account of the natives, with illustrations, see SCIENTIFIC AMERICAN SUPPLEMENT, No. 688.

© 1889 SCIENTIFIC AMERICAN, INC

to the harbor, were lost sight of in the sympathy extended to all in the face of this terrible storm visitation.

IMPROVEMENT OF THE RIVER FRONT OF NEW YORK CITY.

The Department of Docks of the City of New York has, for a number of years, been engaged in improving the river front of this city. The work was begun under the administration of General George B. McClellan as Chief Engineer, in 1871. In July, 1875, it passed into the charge of Mr. G. S. Greene, Jr., Chief Engineer of the New York Department of Docks. The work has been principally done on the Hudson River front, where granite bulkheads have been built. Different constructions have been used for different localities. This article is specially devoted to the subject of the new bulkheads that are now being constructed. Two typical forms are illustrated. The wall will be seen to consist of a foundation of concrete or piling or both sustaining a granite wall backed up by concrete. The concrete blocks, which act as a foundation for the granite wall, are backed up by cobble stone and riprap, braced by straight and sloping piling where the nature of the ground requires it. The general method of constructing a wall supported on piling where rock bottom cannot be reached is as follows:

The vertical piling is first driven. It is usually white, yellow, or Norway pine, cypress, or spruce, varying in diameter from 16 to 28 inches, and of a maximum length of about 90 feet. In many instances short piles, however, only can be used, on account of the presence of rock. Where loose stone is to be penetrated, an iron shoe is placed over the foot of the pile. The vertical piles are first driven and the three front rows are cut off 15·3 feet below low water. They are cut by a circular saw worked from a floating pile driver. The saw is journaled to a large timber which is lowered to the proper distance, and the feed is accomplished by moving the pile driver up to its work. The six rear rows of piles terminate 2 inches above mean low water, and are notched at the top to receive transverse caps.

After the vertical piles are driven, cobble stones, gravel, and riprap are put in place around them. As these are put in in layers, the riprap on the outside and cobble stone filling on the inside, each tends to take its own slope, so that a sort of interlacing of the two classes of stone filling occurs. Before the entire cobble stone and riprap filling is in place, binding frames are put in to hold the piles in place. These consist of two pieces of 5 inch by 10 inch spruce placed one above the other. Through the ends 8 inch by 8 inch oak beams pass, and are wedged back against the piling. On the three front rows of piles which were cut off by the circular saw, concrete blocks are placed. Each of these blocks is 7 feet wide on the bottom, 5 feet on the top, and 6 feet in length; their vertical height in front is 13 feet, in the rear 14 feet, affording a step for the granite wall. Each block weighs about 70 tons. Before they are lowered, a mattress, composed of burlaps filled with about two inches of mortar, is placed on top of the piling, which mattress is carried on a network of marlin attached to a wooden frame. When it has sunk to its place divers descend and cut the marlin so that the frame floats upward, leaving the mattress and marlin netting lying on top of the piles. This mortar is made with slow-setting cement, and as quickly as possible the 70 ton concrete base block is lowered on top of it, thus obtaining a firm bedding on the piling, members of which may vary one or two inches in height. More cobble stones are added, and the inclined bracing piles are driven, an inclined pile driver being used for the purpose. These go down between the vertical ones, and are placed at a distance of three feet from center to center; their slope is represented by an inclination of two vertical upon one horizontal. All the piles are adjusted and stay-lathed as soon as they are driven. The bracing piles are now cut off at the top and capped with 12 inch by 12 inch timbers lying horizontally, and more cobble stones and riprap are filled in. The granite wall is completed and backed by concrete, and a general light filling is placed above the riprap. All of these features can be clearly understood by inspection of the drawing. The concrete backing is further protected by a four-inch oak planking. Oak treenails are used for all fastenings, so that the whole represents a structure built without metal, which is, from an engineering point of view, quite a curiosity in the present age of steel. From this peculiarity it has excited much comment abroad.

The moulding and moving of the concrete blocks, which is illustrated in some detail, is a matter of special interest, as they are, probably, the largest moulded blocks ever handled in this manner. They are made in moulding boxes, and consist of two volumes of sand and one volume of Portland cement, mixed dry and moistened down with a sufficiency of water. To this mortar small sized stone, broken so as to pass through a 3 inch ring, is added in such proportions that there will be enough mortar to fill all interstices when rammed. This proportion is determined by hydraulic or water test, as well as by the practical mixing of samples. The concrete will average in its proportions 1 cement, 2 sand, and 5 broken stone; but is found to vary with the stone used. The same is to be said with regard to the water used for mixing the mortar. This is added to the mixture in such quantity as may be required by the particular sand and cement used.

The concrete blocks as moulded have vertical grooves passing down each side, and a groove across the bottom or a hole through their mass near the bottom. This groove, and hole, if present, are for receiving the hoisting chain by which they are lifted, as shown in the large illustration. The floating derrick which raises them has a capacity of 100 tons, and as each block weighs 70 tons, there is quite a surplus of power for handling them. When lowered into position the clevis of the chain is detached and a rope is fastened to the loose end. The derrick then draws the chain out and clears it from the block. By means of the rope the end is allowed to descend just as fast as the other end is hoisted, in order to prevent the chain from being caught in the aperture or on the corners. The hole passing through the block at a distance from the base is found to be objectionable, as tending to cause a fracture of the base, and the method shown in the cut is usually employed.

All this work applies to the formation of a bulkhead or river wall. It is done in sections, much delay being experienced from the opposition made by private owners. By means of this bulkhead a depth of 12 feet at mean low water against the face of the wall is secured, which is considered a sufficient depth for any vessel 200 feet long, that being the maximum length between piers. Where rock bottom exists the piling is dispensed with and concrete in bags is used for the base blocks to rest upon. An example of this construction is shown in one of the cuts. Different shaped concrete blocks are employed for different situations also. The general type is given here.

Through the concrete blocks weep holes are carried from rear to front, which are left open in order that water accumulating in the filling may have a chance to escape. When the blocks are put in place, it will be seen that the vertical grooves must come together. They are filled with concrete in bags rammed down, so that a species of tongue is formed, anchoring the blocks together and preventing transverse displacement. The granite headers of the wall are dovetailed at their rear end, so as to be anchored back into the concrete, while a firm longitudinal bond is given by the breaking of joints in the stretcher courses. One feature of the work is the thorough ramming to which the concrete is subjected, the object being to have stone touch stone in the mixture, to have no space between them, and to have sufficient water to insure setting. The quality of the cement is of the best, and it is subjected to elaborate tests for strength, time of setting, color, etc. In one section, where the piling failed to reach hard bottom, the whole structure is practically floating on a soft mud. Yet this section appears to be as secure as any.

The Outer Ring of Saturn.

BY JAMES E. KEELER, ASTRONOMER OF THE LICK OBSERVATORY.

In the *Sidereal Messenger* for February, 1888, and more recently in *Ciel et Terre*, I described the appearance of a very fine division on the outer ring of Saturn, which was seen on several occasions with the 36 inch equatorial immediately after its erection at the observatory, and particularly well on the night of January 7, 1888. In the year which has elapsed since the time of its discovery, the division has been repeatedly looked for by different members of the observatory staff, but without success; and I had come to the conclusion that it was either invisible by reason of the greater obliquity of the ring, or that it was of temporary character, and no longer existed. More recent observations show that our failure was due simply to the lack of sufficiently good definition.

On the night of March 2, which was one of the finest that we have had at the observatory, the division was seen by Professor Holden, Mr. Schaeberle, Mr. Barnard, and myself, and was independently estimated by all four observers to be situated at one-sixth of the width of the outer ring from its outer edge.

Mr. Barnard and I continued to observe the planet, with different magnifying powers, until after it had passed the meridian. The brilliancy of the whole system, particularly of the gauze ring, was remarkable, and the outlines appeared with a sharpness more characteristic of the lines of a steel engraving than of the usual telescopic image. With a power of 400, a faint shading could be seen on the outer ring, A, at about one-third of its width from the outer edge. If no higher power had been available, we should have said that we had had an excellent view of the Encke division (or shading).

With a power of 1,500 the appearance was different. The division near the outer edge of the ring then became visible, not as a shade, but as a distinct black line of exceeding fineness, and from this a dark shading extended inward nearly to the inner edge of the ring. Mr. Barnard placed the maximum depth of shade at one-third the distance from the outer edge, or where the Encke shading appeared with the lower power. To me it seemed farther out, nearly at the division which separated the shading from the brighter margin of the ring. The narrow strip lying between the division and the outermost edge of the system appeared to both of us to be the brightest part of ring A.

The outline of the planet's shadow on the ring was seen with the greatest distinctness, and was a perfectly smooth curve, agreeing, as nearly as we could judge, with that required by geometrical principles. A very minute irregularity could easily have been detected.

In my opinion, the division described above is a permanent feature of the outer ring, but it is so minute that it may fairly be classed among the most difficult and delicate of planetary details, requiring the most powerful instruments and exceptional atmospheric conditions for its observation.—*The Astronomical Journal.*

A Suggestion for Fuel at Apia, Samoa.

The question of cheap fuel is important to us all, and none the less so in the oil regions, where to burn up our surplus stocks means better prices for our commodity.

To obtain perfect combustion in burning crude oil as a fuel under boilers, stoves, etc., is and has been a desideratum.

The best device brought to my notice is a cast iron burner, which is placed in the fire box of a boiler and connected to an oil retort by pipes having the necessary shut-off cocks, with a slight fall toward the burner.

This burner is also connected by pipes, etc., to the boiler itself for steam.

In order to start the fire, you have only to turn on a small amount of oil and ignite it. Then open the steam connections to burner, and as the oil passes through the burner it becomes superheated into gas, and as the gas and steam blend and rush into the firebox, you have a gas fire at once of most intense heat, and as effective as natural gas, and when the steam and oil supply are adjusted, nearly perfect combustion is obtained.

In case you do not have steam up when the burner is started, and have water pressure at hand, the burner is adjusted to make its own steam.

What suggested this letter were the numerous articles in the papers of late indicative of anxiety at our naval headquarters as to our fuel supply for war ships centered at Samoa; also the need of a fuel for the navy that would steam quickly.

For the war ships plying the Pacific Ocean at Samoa, I would suggest the government erect, at Pago-Pago, several iron tanks of two thousand barrels capacity each, near the coaling docks; to connect these tanks with the docks, by pipe lines and proper shut-off cocks; to buy crude oil from the California or Ohio oil fields and have it delivered at the nearest seaport harbor, and thence transported in bulk in ships to Pago-Pago and stored in these iron tanks to be used when wanted.

About 3 to 3½ barrels of oil (weight about 350 pounds to 42 gallons) equals in heating units a ton of coal.

Crude oil can be purchased at Hueneme, California, on the coast, for about two dollars per barrel, or in Ohio on cars for 35 cents per barrel.

Have made for each ship a certain number of iron air-tight storage cylinders, the number to be regulated by the rules that govern the coal supply.

Put an oil burner in each boiler, to be connected with and supplied by these storage cylinders, which in turn are fed from the tanks on shore before the ship leaves the harbor.

Keep steam in one boiler continually, and this will call for very little oil if the steam supply is not drawn upon, and the amount of oil can be regulated so as to keep a certain amount of steam with no waste of fuel.

Now, then, an order is given to steam ready for action.

The boats using oil fuel will be ready and off long before the coal burners will have steam up.

Steam can be raised this way as quick as if generated by natural gas. This system of burning oil can be used to steam up with only, and then use coal, or if desired, coal and oil can be burned simultaneously.

The greatest danger to be overcome would be to store these oil cylinders where they could not be reached by the enemy's shot.

The cost of firing with oil wholly would reduce the firemen's pay roll three quarters. C. L. GIBBS.

Titusville, Pa.

A Valve for Electricity.

A device which may be of considerable value is described by M. Neyreneuf in the *Journal de Physique* as an electric valve, by means of which the current can be sent in one direction, but not in the other. With a voltameter constructed of two aluminum electrodes, dilute acid as electrolyte, and an alternating current, he found that pure hydrogen was evolved at both electrodes, but on making up an arrangement with one electrode of aluminum and one of mercury, using distilled water as electrolyte, the current was found to pass in one direction only.

© 1889 SCIENTIFIC AMERICAN, INC

EXPERIMENTS IN MAGNETISM.

BY GEO. M. HOPKINS.

When a piece of soft iron is placed in direct contact with the poles of a permanent magnet, the magnetic force is nearly all concentrated upon the soft iron, so that there is very little free magnetism in the vicinity of the poles of the magnet. This may be readily shown

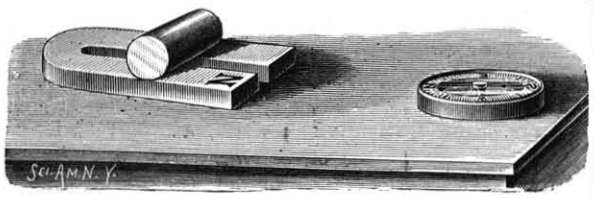


Fig. 1.—EFFECT OF THE ARMATURE.

by arranging a U-magnet parallel with the magnetic meridian, placing in front of and near the poles of the magnet a compass so adjusted with reference to the poles as to cause the needle to rest at right angles to the magnetic meridian, then applying to the poles of the magnet a massive armature. It will be found that the needle, under these conditions, immediately tends to assume its normal position, showing that the power of the magnet over the needle has been, to a great extent, neutralized. By rolling a cylindrical armature along the arms of the U-magnet, as shown in Fig. 1, it is found that as the armature recedes from the poles of the magnet the influence of the magnet upon the compass needle is increased, while the movement of the armature in the opposite direction diminishes the power of the magnet over the needle.

In Fig. 2 is illustrated an example of temporary magnetization by induction, and of the effect of a permanent magnet on the iron so magnetized, showing that the iron bar inductively magnetized acts like a permanently magnetized needle. The soft iron bar is freely suspended, and receives its magnetism from the fixed magnet. The end of the suspended bar adjacent to the

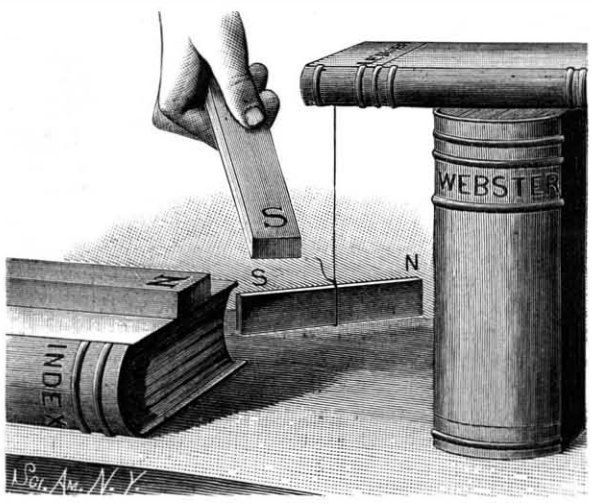


Fig. 2.—PERMANENT MAGNET AND BAR MAGNETIZED BY INDUCTION.

N pole of the magnet becomes S, as may be shown by presenting to it the S pole of another permanent magnet. The S end of the swinging bar will be immediately repelled. If the S end of the permanent magnet be presented to the opposite end of the suspended bar, the reverse of what has been described will take place, *i. e.*, that end of the bar will be attracted, showing that its polarity is N.

In Fig. 3 is illustrated an experiment showing the neutral effect produced by induction from two dissimilar magnetic poles. A bar of soft iron is arranged near, but not in contact with, the pole (say the N pole) of a magnet, so that it becomes magnetized by induction to such an extent as to support a nail. The N pole of the magnet produces S polarity in the end of the soft iron bar adjacent to it and N polarity in the opposite end. The S end of another permanent magnet presented to the same end of the iron bar will produce exactly the opposite effect in the bar, and will, therefore, neutralize the magnetism induced in the bar by the first magnet and cause the nail to drop.

A similar effect is produced when the iron bar is in actual contact with the N pole of a magnet and the S pole of another magnet is brought into contact with the opposite end of the bar, as shown in Fig. 4. The nail will adhere to the bar when either magnet alone is in contact with the bar; but when dissimilar poles are brought into contact with opposite ends of the bar, its middle portion becomes neutral, and is no longer able to support the nail.

When like magnetic poles are presented to the ends of the iron bar, as in Fig. 5, a strong consequent pole is

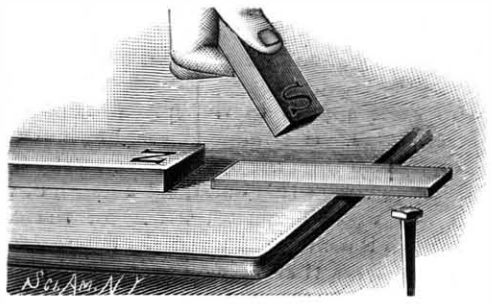


Fig. 3.—NEUTRALIZING EFFECT OF AN OPPOSING POLE.

developed in the center of the bar, which is of the same name as that of the ends of the magnets touching the bar.

Luminous Cascade for the Exposition.

At the Academy of Sciences M. Troost described an apparatus, newly imagined by M. Beckman, for illuminating large size jets of falling water. Colladon's method, hitherto employed, consists in the use of a hollow cylinder containing water under pressure. Several holes allow the water to flow down in the shape of parabolic jets, and little windows on the opposite side of the cylinder enable the operator to throw a pencil of electric light into the axis of each one of the jets. The effect, probably known to most readers, says the *Chemist and Druggist*, is exceedingly fine, as the light follows the course of the water, and each jet sparkles like liquid fire. Unfortunately the plan will not work with high pressures, when the jets are, for instance, thrown much farther than one meter from the cylinder. In the new system devised by M. Beckman the jets will be, owing to an ingenious form of faucets, hollow instead of solid, and the electric light will be projected into the central space. It has been found that streams of water may thus be illuminated throughout, even when thrown 4½ or 5 meters from the cylinder or fountain, and a brilliant night display is expected in the exposition gardens.

REMARKABLE LOCOMOTIVE EXPLOSION IN NORWAY.

We give an engraving of a remarkable explosion of a locomotive, which took place at Strommen, December 22, 1888. By the force of the explosion the locomotive was thrown upward and capsized, and came down bottom up, alighting upon an adjacent locomotive that was standing on the track. Our illustration was prepared from a photograph of the two locomotives as they appeared soon after the occurrence.

New Antidote for Morphine.

Professor Bokai, of Klausenberg, believes that the best antidote for morphine is picrotoxin. The two substances act in an opposite manner on the respiratory center, morphine paralyzing its action, while small doses of picrotoxin increase it. As in poisoning by

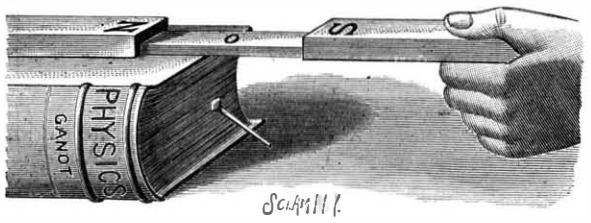


Fig. 4.—NEUTRAL POINT BETWEEN UNLIKE POLES.

morphine death occurs from paralysis of the respiratory center, and as picrotoxin hinders this paralysis, it follows that picrotoxin is likely to be of real use in morphine poisoning. In morphine poisoning, diminution of the blood pressure plays an important part, but picrotoxin enjoys the property of stimulating the vaso-constrictor center of the medulla and thus counteracts the effect of the morphine. Once again, the action of these two substances on the cerebral hemispheres is also of an opposite character. As atropine, the only known antidote of morphine, cannot be administered in large doses, it is certainly desirable that other means of combating morphine poisoning should be sought for. Professor Bokai thinks that picrotoxin may be useful as a substitute for preparations of nux vomica, and he also believes that it will be found of value in preventing chloroform aspbyxia.—*Lancet.*

Dredging Sand and Silt.

In *Les Annales des Ponts et Chaussees*, M. Boulle describes a form of dredger in which the removal of sand or silt is effected by an injection of compressed air instead of by suction. The machine consists of a tube passing through the water to the bottom to be dredged, and a compressed air injector placed at the bottom and at right angles to another pipe. The injector surrounds the main tube, and is fitted with a number of small mouthpieces producing a flow of a mixture of

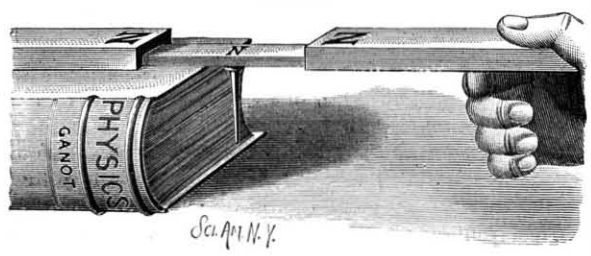
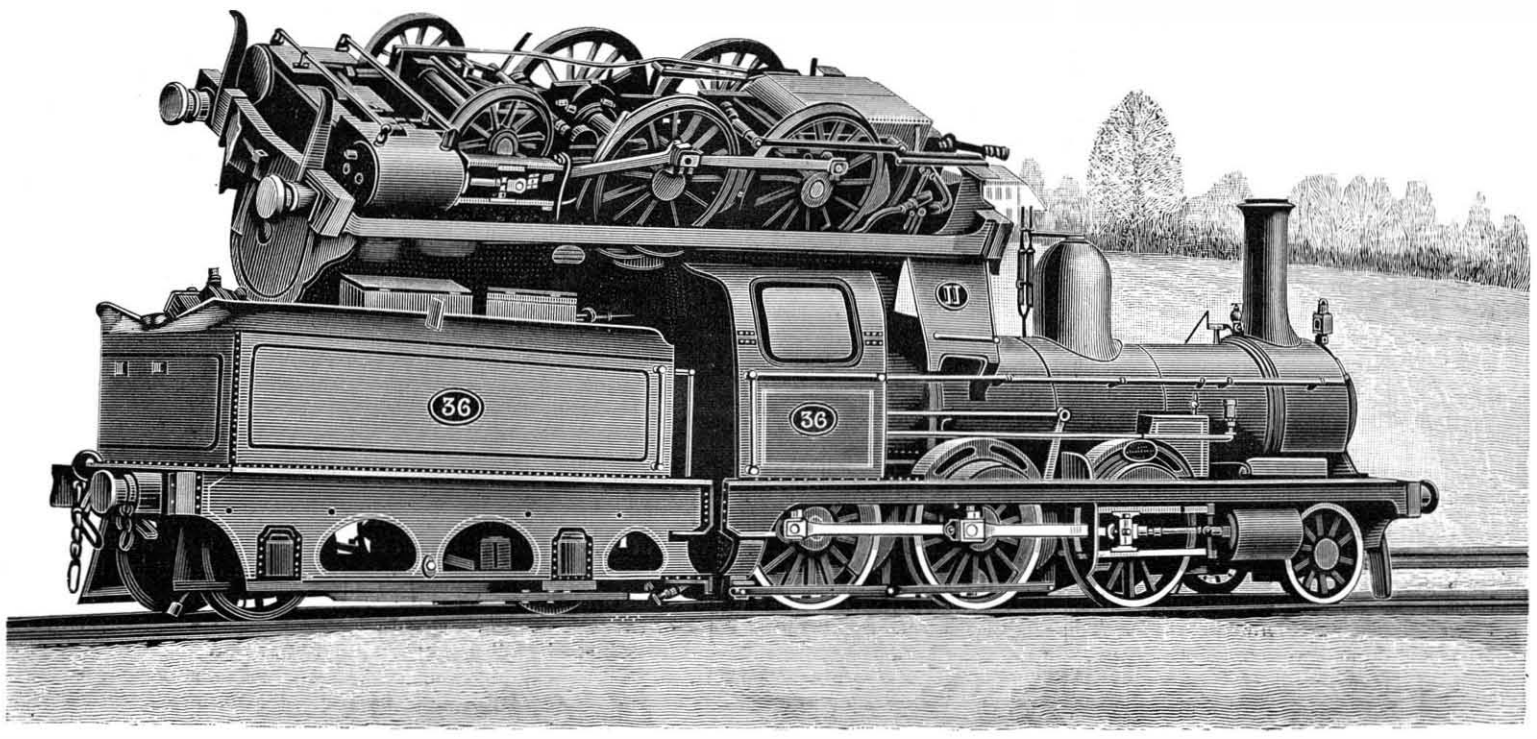


Fig. 5.—CONSEQUENT POLE.

water, silt, and air up the main tube. In a trial at Saumur, on the Loire, the main tube was 4 inches in diameter, and sand was dredged from a depth of 15 feet, lifted 5½ feet above the water level, and finally transported to a distance of 50 feet. The compressor was of 15 horse power, which drew in 3·53 cubic feet of air per second, and by it raised 130 cubic yards of sand-burdened water per hour, the sand constituting from three-tenths to four-tenths of the whole volume. At Havre a 9 inch tube was used, and the depth was from 26 feet to 30 feet. Using a compressor of the same power as at Saumur, 390 to 520 cubic yards of silt and water were lifted per hour, the silt forming one-quarter of the whole. The dredger is most efficient in soft silt, sand, or gravel, but stones weighing 22 pounds have been removed by it, using the 9 inch tubes.



REMARKABLE LOCOMOTIVE EXPLOSION IN NORWAY.

© 1889 SCIENTIFIC AMERICAN, INC

Climatic Influence of Forests.

It is a popular induction that extensive forests or plantations promote the depression of moisture in the atmosphere, and that the removal of such growths, whether by felling or conflagration, makes a region dry and unfruitful, while their judicious cultivation and tendence keeps up or even creates the fertilizing rain supply. Of late years this view has been disputed, and at the present moment there is a controversy being carried on, mainly between German and American climatologists, as to whether it has any foundation in fact—whether it is not, like some other popular inductions, due to a misreading of natural phenomena or to a transposition of effect and cause. Gunther and Ebermayer, supported by English observers like Blandford, whose East Indian experience supplies many of the most significant data to the upholders of the popular view, are quite convinced that that view will ultimately be the scientifically accepted one. They point to the well known tree in the Canary Islands, which, standing alone, absorbs from the sea breeze the moisture with which it bedews the ground beneath; they cite the so-called rain trees of the tropics, which condense the watery vapor in such volume that they give it out in a kind of modified shower bath, which converts the soil around them into a swamp; and they adduce the authority of Fautrat, who has made comparative statistics of the condensing power of the different trees in European forests, and who shows that the best condensers are the firs, whose needles contain more than 50 per cent, while the foliage crowns of the leaved timber detain at most 42 per cent, of the water that descends on them.

These highly significant facts, however, do not constitute scientific proof, the materials for which are only of late years beginning to be compiled under the requisite conditions of period and locality. So far as they have gone, the researches of Brandis and Studnika may legitimately be claimed as tending to a provisional confirmation of the popular induction; and if they are ever to be set aside, or even modified, it must be by better observation and argument than those employed by their more strenuous transatlantic opponents. Even the ablest of these, Mr. Henry Gannett, does not deny a certain meteorological influence of forestculture on soil productiveness. He admits that land under tillage retains its moisture better than land not so treated, and that woods equalize temperatures and air currents and act as water reservoirs. But some of his divergences from the popular view are surely inadequately reasoned out; for example, that the great superficial area made up by leaves favors evaporation and sends back to the air a large proportion of the rain which, unintercepted, would go straight to the soil, which is thus impoverished of its due supply of moisture. To this objection Ebermayer can rejoin that evaporation in the forest is two and a half times less than outside it; nay, Clavé makes it as much as five times less. If we take into account the protective covering of the soil caused by the leaves that have been shed upon it, then, compared with the evaporation from the free or woodless ground, we get a diminution of more than 80 per cent! The practical question, however, lies not so much in the increase or diminution of the rainfall as in its distribution.

Van Bebber, in his work on the "Influence of Forest Growth on Climate," shows that wood culture increases the rainfall, but that it acts more favorably on the weather by promoting an equable distribution of the moisture and by obviating extremes of temperature. "This effect," says one of Gannett's German critics, "is left completely out of account in the American's investigations, and it is therefore quite possible that reafforesting, without notably increasing the annual volume of rainfall, may yet have considerably enhanced the fertilizing effect of the prairie showers. The old experience that the destruction of woods accentuates climatic extremes, and more especially enhances the danger of floods, has not thus far been contradicted. Nay, it receives calamitous confirmation in the disasters which, in the south Tyrol, for example, recur so frequently, and which it is vainly sought to prevent by artificial works." For the medical climatologist, as well as for the agriculturist, the further prosecution of the researches on the relation between forest growth and rainfall now so vigorously carried on in Germany is as practically important as it is theoretically interesting.—*The Lancet, London.*

THE TWIN PALMS AND ANCIENT WELL OF LOS ANGELES.

The accompanying engraving is from a photograph taken by our correspondent, Mr. A. W. P. Kinney, of Los Angeles, and shows the "Twin Palms" on San Pedro Street, Los Angeles, Cal. Mr. Kinney says:

These trees are of the fan palm species, and are gigantic in size, being probably the largest in the United States.

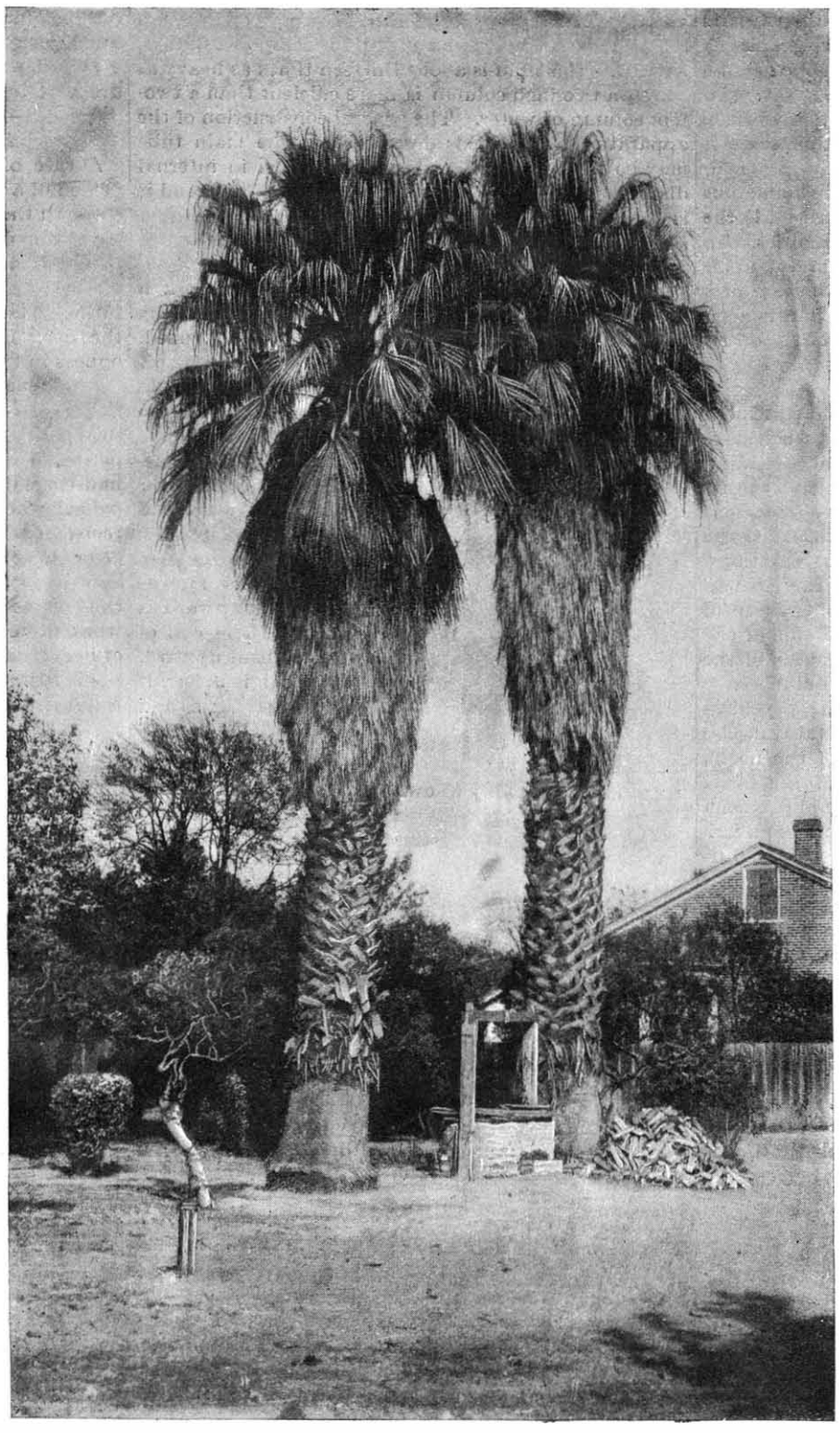
It is supposed they were planted by some of the mission fathers who founded the old Spanish missions on the Pacific coast. They may be classed among the wonders of sunny California.

They are about ninety-five feet in height and seven feet in diameter. Their age is variously estimated, but it is safe to say that they are over one hundred years old.

During this period they have witnessed the growth of Los Angeles from a Spanish pueblo of adobe huts to the metropolis of Southern California.

Near these palms there still may be seen a well of great antiquity, whose waters have refreshed, perhaps, many of the ancient Aztecs, the children of the sun.

The well and palms together form an interesting study for the historically inclined tourist and scientist, as well as the botanist and antiquarian.



THE TWIN PALMS AND ANCIENT WELL OF LOS ANGELES.

MR. COE F. YOUNG, for many years vice-president and general manager of the Delaware and Hudson Canal Company, died at Thomasville, Ga., March 22, at the age of 65. He was appointed superintendent of the canal department of the company in 1865, and five years later became general manager of the railroad and canal systems, which position he held until three years ago.

The Japanese as Colporteurs.

One embarrassment attending the colporteur work in Japan is due to the fact that any kind of trade has always been considered as degrading here. Persons engaged in trade are looked upon as beneath ordinary laborers, and next in rank to coolies or beggars. As the result of this, the business of the country is mostly in the hands of unscrupulous persons, with no reputation to gain or lose, and is conducted in a very loose and unsatisfactory way. There are but few merchants who appear to have a high sense of honor and a fixed price for their goods. The price demanded is usually adjusted to the supposed ability of the purchaser or the present need of money on the part of the seller. No foreign firms will trust the Japanese in business transactions, and every large establishment in Yokohama employs the Chinese to handle the money and watch for fraud.

Bible selling is also a kind of trade, and men who peddle Scriptures are generally classed with hucksters of all sorts. Those who engage in this business are usually without other means of support, and have no experience in our work or much idea of what we expect of them. They naturally adopt the usual methods of trade; and there is no end of trouble in teaching them to keep their accounts properly and deal honorably with all. It is a new departure in business to adhere strictly to the price marked in a book, and we have detected some of them putting in a new price on top of ours. It does not follow from a man's joining a church in Japan that he understands the art of selling Bibles after the methods in vogue at home. It is a matter of fact that Bibles are being sold in Tokio and Osaka constantly at less than our retail prices. One firm even advertises them at about *twenty per cent* less than the catalogue rate. Where they can procure them and by what means is more than I can tell. Of course, they refuse to let us know the process.—*H. Loomis, in the Bible Society Record.*

To Make Sheet Wax.

Dr. H. E. Beach, Clarksville, Tenn., says: Take of pure, clean wax anywhere from one to five pounds, put in a tin bucket or any deep vessel, with clear water sufficient to fill it within two and a half inches of the top. Set on the stove till thoroughly melted, then set aside until partially cooled; skim all the air bubbles off. Then fill a smooth, straight bottle with ice water, a bucket of which you should have by you. Soap the bottle and dip it deliberately in the solution two or more times, according to the thickness you desire your wax. After the last dip, as soon as the wax hardens to whiteness, cut a line through it and remove it from the bottle as quickly as possible. Spread to cool and straighten out smooth while warm. Continue this process until all the wax is made into sheets.

Any office boy or girl can do the work, and make enough sheet wax in an hour—equal to any you can buy—to last a whole year. Paraffine, or paraffine and wax, may be made in the same way, and colored and perfumed to suit one's fancy. The water in the bottle should always be kept cold in order to get the best results.—*Archives of Dentistry.*

Steel Pipe.

Public attention in this country having been called to the experiment of steel pipe manufacture in Glasgow, Scotland, the *Ohio Valley Manufacturer* says: "While our English cousins have finally 'caught on' to what is destined to be a great and important industry in the line of pipe manufacture in the world, it may not be entirely inappropriate to inform them that what to them is a new discovery is an accomplished facton this side of the ocean. The manufacture of steel pipe has passed its experimental stage here, and is now both a successful and an acknowledged article of commerce. Its manufacture in this city was begun in August, 1887, and since that date some 15,000 tons have been manufactured and shipped into nearly every State and Territory in this country, and large quantities have been sent to Mexico. The Riverside Iron Works, of Wheeling, were the first, and up to the present time are, we believe, the only, manufacturers of steel pipe in America."

© 1889 SCIENTIFIC AMERICAN, INC

Normal Sleep an Effect of Inhibition.

In the January and April numbers of the *Archives de Physiologie Normale et Pathologique*, Dr. Brown-Sequard has a paper in which he adduces the reasons that have led him to the conclusion that normal sleep is the effect of an inhibitory act. He says:

The theory according to which sleep depends upon a vascular contraction taking place in the cerebral lobes is, as I have long since shown, absolutely false. In fact, I have found that guinea pigs and rabbits, after a section of the two great sympathetic nerves, in the neck, sleep as if the cerebral circulation were in a normal state; that is to say, when it can cease through vascular contraction. The same is the case with dogs and cats after the upper cervical ganglion has been removed from one side, and the vago-sympathetic has been cut from the other. When, through these operations, the blood vessels of the brain have been paralyzed, it is evident that the sleep which then occurs not only does not depend upon a cerebral anæmia through vascular contraction, but may also exist despite the opposite state, that is to say, a hyperæmia, even a notable one. It is therefore certain that sleep may exist whether there is little or whether there is much blood in the vessels of the brain.

The loss of consciousness in sleep, as in numerous other accidental or pathological circumstances, is the effect of an inhibition of the cerebral faculties. To establish this opinion, I rely (1) upon direct proofs showing that the loss of consciousness, in the case of a puncture of the bulb and in other cases also, is beyond all dispute due to an inhibitory act; and (2) upon all that is known of the circumstances that precede or accompany sleep.

On this subject I shall limit myself to the statement that, just as in every inhibition, there exist, when sleep occurs and as long as it lasts, irritations at a distance from the organs in which the cessation of activity takes place. We find a proof of the existence of irritations in the following particularities: (1) What is called the need of sleeping, which consists in certain sensations, and particularly a feeling of heaviness in the eye; (2) persistent contraction of the pupil; (3) contraction of the palpebral orbicular muscles; (4) contraction of the inner and upper rectus muscles; (5) contraction of the blood vessels of the retina and of the cerebral lobes.

I add that, besides the inhibition of the psychical faculties, there is a special inhibition of certain muscles (muscle of the upper eyelid and muscles of the neck), and perhaps also a degree of inhibition of the heart and respiration. These various inhibitory phenomena associated with sleep well show the existence of an irritation somewhere, and perhaps at several points, during this periodic cessation of the intellectual activity.

The production of sleep in man in the experiment of Fleming and Waller (consisting in a pressure exerted at the same time upon the carotid, cervical sympathetic, and pneumogastric nerve) well shows that sleep may proceed from a peripheric irritation. To this fact, it is of consequence to add that which is well known regarding the somniferous influence of certain gastric irritations.

As for the seat of the irritation or irritations caused by sleep, I can say no more than this: (1) It is not probable that it is located in the brain properly so called, for, as we know, birds (especially the pigeon) sleep and awaken periodically after, as well as before, the ablation of their brain; (2) the reflex contractions and the paralytic inhibitions which are associated with sleep, if we consider them as due to irritations proceeding from the same point, much more probably have their seat in the excitable parts of the base of the encephalus than in the cerebral lobes.

Before concluding, I shall recall the fact that, in the epilepsy that I produce in guinea pigs, the loss of consciousness, like the convulsions, is easily caused by a peripheric irritation, and that it is thus so caused sometimes in the attacks of cerebral epilepsy in man. I shall recall also that the loss of all cerebral activity may occur through inhibition, as I have shown, under the influence of irritations, even very slight ones, of the base of the encephalus or of the spinal marrow, but especially of the point that Flourens has named the vital center.

From all these facts, there is no doubt that irritations, with various seats, exist during sleep, they having begun a little before the moment at which it supervenes. There is, then, every reason to accept as a fact that the phenomenon of ordinary sleep, that is to say, the loss of consciousness, is the effect of an inhibitory act.—*Revue de l'Hypnotisme.*

The Electric Age.

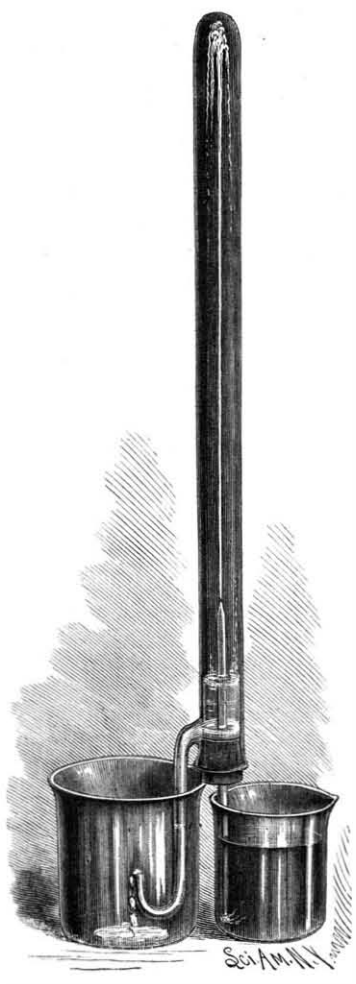
Professor Elisha Gray remarks that electrical science has made a greater advance in the last twenty years than in all the 6,000 historic years preceding. More is discovered in one day now than in a thousand years of the middle ages. We find all sorts of work for electricity to do. We make it carry our messages, drive our engine, ring our door bell, and scare the burglar; we take it as a medicine, light our gas with it, see by it, hear from it, talk with it, and now we are beginning to teach it to write.

MERCURIAL JET SIPHON.

T. O'CONOR SLOANE, PH.D.

The ordinary jet siphon, reproducing to a certain extent the experiment of the fountain *in vacuo*, is one of more than ordinary interest. A descending column of water, acting as one member of a siphon, is caused to rarefy the air contained in a cylindrical vessel. At the same time water admitted through a jet in the base of the vessel forms a fountain. The descending column may be quite long, and there is no difficulty in producing a fountain two or three feet high, provided the vessel is large enough. This factor of height of fountain depends upon the length of the descending column, and is greater or less as the latter is longer or shorter. The water can never rise in the fountain to a height equal to the length of the actuating column, on account of friction.

In the cut accompanying this article a very pleasing variation upon this experiment is shown. The descending and actuating column of fluid is composed of mercury. As this fluid is about thirteen times as heavy as water, a two-inch column is more efficient than a two-foot column of water. The general construction of the apparatus hardly needs description. The main tube may be half or three quarters of an inch in internal diameter and fifteen inches high. At its upper end it is sealed. Its lower end is provided with a perforated India rubber cork. Through the aperture in the cork a small tube about six inches long is passed. At its upper end this tube is drawn out to a fine jet, great care being taken to have it true and symmetrical, so as to deliver a straight jet of water. Sealed into the side of the large tube is an outlet tube, carried downward as shown. The end of this is bent upward, or, what is better, it is left straight, and a U shaped piece is attached to it by a piece of India rubber tubing. The last construction is the less fragile of the two.



MERCURIAL JET SIPHON.

To use it, the India rubber cork is removed and the tube is inverted, and mercury is poured in to a depth of two or three inches. The cork, with its jet tube, is then replaced, and the finger is held firmly over its open end. The whole is then quickly inverted so that the end of the U-shaped discharge tube is simultaneously brought into or over a beaker or other vessel. Most of the mercury runs out, the bent tube preventing the access of air. Then the end of the jet tube, which hitherto has been kept closed with the finger, is placed under water contained in a second vessel, and the finger is removed. At once, under the influence of atmospheric pressure, the water enters the partially exhausted tube, and rises to its top, forming a fountain. The rest of the mercury gradually escapes, but the jet, if small enough, may last for several minutes.

The interesting feature is involved in the action of a column of liquid but a few inches long producing a jet over a foot in height. It represents the correlative of the experiment of the direct mercurial fountain, shown in the SCIENTIFIC AMERICAN of Oct. 23, 1886.

Paraldehyde as a Hypnotic.

Dr. John Gordon gives in the *British Medical Journal* a valuable contribution to the study of paraldehyde, which is of special interest to us from the fact that the writer, before entering the medical profession, was a pharmacist of note in the North, and still retains his connection with pharmacy. The study of which we have here the results formed, we understand, the subject of the writer's doctorate thesis, and, as it places the hypnotic in a favorable position as a remedy, it is likely to create new interest in and further trial of paraldehyde. The drug was introduced by Dr. Cervello, of Palermo, in 1883, and after a year or two's fair trial has fallen into the rank of occasionally used remedies. Dr. Gordon, in his paper, shows that even in healthy individuals it produces short sleep, and in full doses—about 40 minims—given to individuals suffering from insomnia, it speedily produces a tranquil slumber. One good feature noticed was that the same dose was taken for some months with equally good hypnotic results; there was no marked craving for the drug; and as it does not, except in large doses, have a hypnotic effect on persons not suffering from sleeplessness, there is no probability of its abuse.

The action of the drug is speedy, patients generally falling asleep within ten minutes after its administration, and they may be aroused while under its influence without any disagreeable or confused sensations. It is not liable to disorder the digestion, although in many cases it is gently laxative in its action. No loss of appetite follows its use, nor headache, nor thirst. The most serviceable dose for adults is from 45 to 60 minims. Dr. Gordon's method of prescribing the drug is to well dilute it with cinnamon water, adding a little sirup of tolu and compound tincture of cardamoms. Sirup of lemon is also an agreeable combination. There is a good formula of this nature in "The Art of Dispensing." Dr. Gordon's paper contains, we may add, a very full account of the physiological action of the drug.—*Chemist and Druggist.*

The Paraldehyde Habit.

A case of this kind is described as occurring in the person of a maiden lady of forty-two years of age who, through the assistance of her physician, was conducted from the use of morphine and chloral into that of paraldehyde, and he could get her no further. All attempts at abandoning the pernicious habit have been futile. The lady now consumes one ounce or more of the drug daily, and has taken as much as twenty ounces in twelve days. She cannot sleep unless under its influence, and when deprived of its use for a few hours she is languid, restless, miserable, suffering physical pain and mental depression, and she has no appetite. Unlike morphine deprivation, she has no exhausting diarrhœa, muscular tremors, or "electric pains," when without the paraldehyde, but, like all remedies which exercise marked psycho-neural restraint after long-continued use, the patient misses, in a marked and painful manner, the sudden withdrawal of the long-accustomed nerve impression. She has somewhat prematurely reached her menopause, and some of her irritability and debility may be due to that; but she is irritable, exhausted, and collapsed when the drug is not circulating in her blood.—*Alienist and Neurol.*

The National Academy of Sciences.

This body held its annual meeting this year at the capital of the country, and the city of Washington was, for several days after April 16, a sort of Mecca of American scientists. The first paper read on the opening day was by Prof. Charles S. Pierce, of the Coast Survey, on "Sensations of Color." Another paper, by Prof. Wolcott Gibbs and Hobart Hare, gave an account of the methods and results of a systematic study of the action of differently related chemical compounds upon animals. Prof. Cope read a paper describing the mammals, reptiles, birds, and other animals found in fresh water deposits in Oregon, Nevada, and Utah.

At Wednesday's session the annual election of officers took place, Prof. O. C. Marsh, of New Haven, the present incumbent, being re-elected president, while Prof. S. P. Langley was elected to succeed Prof. Simon Newcomb as vice-president. The papers read included one on "Composite Chronology," by Prof. D. P. Todd, of Amherst, one on the "Determina- of Gravity," by Prof. C. S. Pierce, and one on "North American Proboscidæ," by Prof. Cope.

At a following session six important papers were read, one by Asaph S. Hall, Jr., on "The Mass of Saturn," three by Professor Remsen, on "The Nature and Composition of Double Halides," "The Rate of Reduction of Nitro-Compounds," and "The Connection between Taste and Chemical Composition," one by Professor Mendenhall, upon recent researches in atmospheric electricity, and one by Professor A. A. Michelsen, on "Measurement of Light Waves."

On the last day of the meeting, April 19, Prof. Michelsen read an interesting paper on "The Feasibility of the Establishment of a Light Wave as the Ultimate Standard of Length," and Prof. S. C. Chandler, of New Haven, one on the general laws pertaining to stellar variations. Dr. J. S. Newberry, of Columbia College, presented a paper, with elaborate illustrations, on the cretaceous flora of North America, and another paper was by Prof. Cleveland Abbe, on "Terrestrial Magnetism."

Prof. Asaph Hall was re-elected secretary of the Academy, and the council for the ensuing year are: Prof. Geo. J. Brush, mineralogist, of New Haven; Prof. B. A. Gould, astronomer, Cambridge; Prof. Ira Remsen, chemist, Johns Hopkins University; and Gen. M. C. Meigs, Washington.

The newly made academicians include two astonomers, Prof. Lewis Ross, of the Dudley Observatory, Albany, N. Y., and Prof. Charles S. Hastings, of the Sheffield Scientific School, New Haven; one paleontologist, Dr. Charles A. White, of the United States Geological Survey; one botanist, Prof. Sereno Watson, of Harvard; and a chemist, Prof. Arthur Michels, of Tufts College.

© 1889 SCIENTIFIC AMERICAN, INC

RECENTLY PATENTED INVENTIONS.

Mechanical.

LATH SAWING MACHINE.—David S. Abbott, Olean, N. Y. This invention covers a novel combination and arrangement of parts in a machine whereby, by reason of the angle of the forward shafts, the feed rollers cause the material fed to draw toward the guide, even when the saw is dull, and prevent the tendency to draw the material the other way, preventing the ends of the lathe from being made thin.

WINDMILL. — Edgar C. Beebe and Riley Stoner, Glen Elder, Kansas. This invention provides simple and efficient means for the automatic adjustment of the windwheel in accordance with the force and direction of the wind, without a vane, and for the automatic government of its work, so that the speed of the windwheel will remain practically constant.

LACE PAPER MACHINE. — Giuseppe Paci, New York City. Combined with a pattern wheel are two wheels having wooden rims, with means for holding them in frictional contact with the pattern wheel, together with a roller having an elastic rim held on top of the pattern wheel, the machine also having other novel features, while the paper is passed through a box containing soapstone powder, with which it is so coated that the cut strips are easily separated.

Electrical.

NIGHT SIGNALING APPARATUS.—Emil Kaselowsky, Berlin, Germany. This invention covers a means of signaling at sea by differently colored electric lamps brought to view singly or in groups, the current being switched to and from the lamps and a supplementary resistance to produce the signals, with means whereby the current may be maintained at a constant resistance, momentary interruption and extinguishment of the lamps being prevented.

ELECTRIC CLOCK WINDING.—Heinrich Rabe, Hanau, Germany. This is an electrical mechanism for winding clocks having torsion or rotary pendulums, the mechanism being adapted for raising the weight or resetting a spring which drives the clockwork, when the actuating power has been exhausted, the apparatus working automatically.

Metallurgical.

ZINC FURNACE.—Gustaf M. Westman, New York City. Combined with a reducing furnace are regenerators connected alternately therewith, condensers connected with the reducing furnace, coolers connected with the condensers, and a blast engine connected with the coolers and the regenerators, with other novel features, to promote the reduction of iron or zinc ores, and the manufacture of phosphor, sodium, and other substances.

DEPHOSPHORIZING IRON ORE.—Thomas F. Witherbee, Port Henry, N. Y. This is a process which consists in mechanically separating apatite or phosphorus-holding compounds from iron ore, then dissolving the remaining small percentage of apatite with dilute sulphuric acid, and finally washing the ore with water.

HYDROCARBON BURNER.—Frank B. Meyers, Fort Plain, N. Y. This burner is provided with a casing to the front end of which is secured a bell-mouthed tube, usually passing through the mouth of the furnace, whereby air under pressure and atomized oil are vaporized to make a gas to produce a high heat in the furnace, the quantity of air and oil to be mixed being adjusted by a valve and regulator.

Miscellaneous.

CUFF HOLDER.—Stephen V. Thomas, West Branch, Mich. The holder is adapted to fit in the eyes or loops of a cuff button, and has an offset or shoulder that springs past the eye or loop of one button, while on the opposite side of this eye or loop it has a spring that flexes or bows outward to hold the offset or shoulder out of alignment with the button eye or loop.

REFRIGERATING TOWER. — Alfred R. Pechiney, Salindres, France. This invention covers a stone tower, in the interior of which are arranged glass tubes through which cold water is kept flowing for the cooling of free chlorine and vapor of hydrochloric acid, or any mixture of these bodies in the state of gas, the invention covering various novel details of construction and combinations of parts.

GRAIN METER.—Valentin Weber and James R. Harrison, Princeville, Ill. This is a device for use in connection with an elevator of any approved construction, whereby the grain box is automatically dumped whenever a certain weight is obtained, the tripping device acting automatically and receiving its motion from the continuous motion of the elevator shaft.

LAMP EXTINGUISHER.—Alexander E. McLeod, Hallock, Minn. This is a device of simple construction by which, when the light is extinguished, no gas or smoke can escape from the wick and pass into the room, and when the extinguisher is left in closed position there will be no evaporation of oil.

SIDE CURTAIN FOR BUGGIES.—Joseph W. Thomas, Sargent, Neb. This is a curtain constructed of independent upper and lower sections adapted for separate or united use, the sections having button holes along their upper and lower margins, and being made to overlap, making an effective rain curtain to protect the occupants of a vehicle in stormy weather.

WAGON BRAKE LEVER.—William A. and Enoch G. Haney, Media, Kansas. This lever has a slide mounted thereon and pivotally connected to a link, the connecting rod extending to the brake shoe, providing for the application of power to the greatest advantage at the time when the brake shoe is brought against the face of the wheel.

AXLE. — Edward M. Allen, Stafford, Md. This axle is made with connection blocks and upper and lower shafts secured rigidly thereto, with other novel features, being intended especially for use in connection with automatic brake devices forming the subject of former patents issued to the same inventor.

CLEVIS. — Arthur W. Rumsey, Kiowa, Kansas. Combined with clevis bars or sections having extended portions lapped together, with coincident openings, is an elongated link secured in the openings and made to secure the sections snugly together or to permit their movement apart when adjusted relatively thereto.

GATE.—Thomas Tyson, Mound City, Mo. This invention covers novel features of construction and combinations of parts in a gate designed to swing outward from two sides, while the gate may be opened from a distance by a pedestrian or a party in a vehicle, the means for operating it being simple, durable, and readily manipulated.

WIRE FENCES. — Dwight H. Scott, Flora, Dakota Ter. This invention provides a device for expeditiously taking up the slack in wire fences and retaining the wire under tension, and whereby also a broken strand of wire may be united without injury to the hands, and such strand be put under any desired tension.

STORE ORDER.—Charles S. Hempstead, Fairchance, Pa. This invention covers a form of order to be used by merchants and others, mainly by retailers, who sell goods in small quantities that aggregate in value a limited and specified sum.

GOODS DELIVERY.—William H. Bailey, Salford, Lancaster County, England. This invention relates to improvements in machines for the delivery of prepaid articles in which a revoluble cylindrical or other shaped magazine is employed to hold the goods to be delivered, the improvement enabling the indicator dial to be set at an oblique angle to the machine, instead of vertically or horizontally.

CHEESE CUTTER. — Bernard Barry, Schenectady, N. Y. This is an improved knife formed of a thin flat plate, one of whose ends is beveled to serve as a straight cutting edge, while one of the longer side edges of the plate is extended laterally at a right angle and provided with an oblique cutting edge, the knife being especially adapted to cut wedge-shaped slices from the body of a cheese by one movement.

LOCK HINGE.—Benjamin F. Boughn, of Randolph, Neb., and William Cashner, of Pleasant Hill, Mo. This hinge consists of two sections connected by a pintle, the knuckles of one section being exteriorly non-circular in cross section, while the other section has a spring-actuated bearing plate pressing against the non-circular knuckles, with a casing in which the plate and its actuating spring or springs operate.

ADVERTISING DEVICE. — Andrew Dahlstrom, Ashton, Mich. This is a display device consisting of a cylindrical body having a series of openings and a tape or ribbon upon which are printed advertisements so placed upon the ribbon as to be always in alignment with one of the openings when the ribbon is revolved, one roller unwinding while an opposite roller winds up the ribbon.

DENTAL MATRIX.—Christ. A. Meister, Allentown, Pa. This is a matrix for teeth, consisting of a band having a body for engaging a tooth, and integral extension of the band consisting of slotted inclined side pieces, a crosshead engaged in the slots of the sides, with means for actuating the crosshead, to be used on a tooth while it is being filled.

SPECULUM. — William Molesworth, Brooklyn, N. Y. This invention provides an implement by means of which the wall of a passage or cavity may be dilated and access had to any portion of the wall while the passage or cavity is held in dilated position.

INSECT TRAP.—Jennie G. F. Johnson, Mount Vernon, N. Y. This invention covers a bait box or receptacle having a surrounding trough adapted to receive a poisonous substance, over which insects cannot readily pass, the whole being inclosed in a structure having an overhanging hood, the device being especially designed as a roach or ant trap.

EXTRACTING COPPER FROM PYRITES.—Josef Perino, Charlottenburg, near Berlin, Germany. This invention covers a process of obtaining copper from copper pyrites, by heating the pyrites mixed with nitric salts of iron to a temperature of about 200° Centigrade, whereby sulphate is produced, lixiviating the mass with water, and finally precipitating the copper.

ORE ROASTER. — Charles J. Fendel, Anaconda, Montana Ter. This roaster has an outer and an inner cylinder connected by tubes, with imperforate passages on both cylinders, the tubes alternately connecting the forward end of a passage on one cylinder with the rear end of a passage on the other cylinder, and the forward end of the latter passage with the rear end of the next one on the first cylinder, whereby a continuous serpentine passage is formed, making a roaster designed to economically calcine the most refractory ores.

PILE DRIVER.—Thomas J. Harriman, New Paris, Ind. This is an apparatus for driving pipes, piles, and fence posts, the invention providing a machine of simple construction, which can be readily and effectively manipulated, and which is so designed that the hammer will at all times strike the pile squarely upon the top, and not miss a stroke by reason of the pile getting out of line.

TANK VALVE. — Nathaniel W. Krouse, Washington, Pa. This is a cut-off valve especially adapted for oil tanks, and serving to close the valve in the pipe line automatically as soon as the oil has been drawn off into the pipe line with which the tank is connected, a spring-pressed valve being located in the pipe line, a bolt engaging the stem of the valve, and a float operating on the bolt to withdraw it when the oil in the tank reaches a low level.

GASOLINE STOVE.—William P. Dunham, Belleville, Kansas. This invention covers a novel construction and combination of parts in an improved gasoline stove, particularly with reference to the valve shaft lever and connection piece, whereby the latter will not slip when properly applied, the construction being simple and effective.

FRUIT DRIER. — Frederick Altman, San Jose, Cal. The drying chamber has a ventilating fine with damper at its top, a central vertical air pipe with apertures opening into the drying chamber, the upper end of the air pipe having an air discharge outlet, an air supply pipe having a regulating valve, a furnace at one side of the drying chamber, in which is a circular hot air flue, with a rotary fruit tray rack located above the hot air flue.

VIGNETTING ATTACHMENT. — Joseph R. Tewksbury, Fort Madison, Iowa. This is an attachment for photographic printing frames, in which an independent frame secured to the face of the printing frame is provided with masks of cardboard or other thin material, certain of which are adjustable in relation to the others, whereby the effect of the light will be broken or softened, a variety of changes being made in an easy and simple manner.

DYEING VAT. — James W. Greaves, Providence, R. I. Combined with a stationary vat is a perforated basket, with a pressure pipe extending from the bottom to the top of the basket, through which the dyeing liquid is forced by steam or pump pressure, the apparatus being adapted for dyeing wool, yarn, and slubbing, or other fibrous material, and to avoid poling.

WELL CURB.—John T. Lenoir, Columbia, Miss. This invention provides an attachment designed for use in connection with any well curb, whereby the water drawn may be delivered without spilling, while the well bucket and rope need not be handled in drawing and delivering the water to a pail, and whereby the well may be securely covered and the cover locked in position.

SCIENTIFIC AMERICAN

BUILDING EDITION.

APRIL NUMBER.—(No. 42.)

TABLE OF CONTENTS.

1. Plate in colors showing elevation in perspective and floor plans for a dwelling costing about four thousand dollars. Sheet of details, etc.
2. Elegant plate, in colors, of a residence of moderate cost, with floor plans, details, etc.
3. Perspective and floor plans of a modified Queen Anne cottage, at East Orange, N. J. Cost, six thousand five hundred dollars.
4. A cottage at East Orange, N. J. Plans and perspective.
5. Page engraving of a stairway in the Chateau de Chantilly. By Mr. H. Daumet.
6. Scenes at Zaandam, Holland, where the Czar Peter the Great learned shipbuilding in 1697.
7. Engraving of the new station and offices of the Great Indian Peninsular Railway, Bombay.
8. Perspective and plans of the new Biological Laboratory, Princeton College, New Jersey.
9. A residence at Roseville, New Jersey, costing five thousand dollars. Plans and perspective.
10. A cottage at Roseville, New Jersey, costing seven thousand dollars. Perspective elevation and floor plans.
11. The Orange Valley Church. Cost, sixty thousand dollars. Perspective and ground plan.
12. A residence at Fordham Heights. Cost, thirty-four thousand dollars. Elevation and floor plans.
13. Perspective view of the new Trinity Methodist Episcopal Church, Denver, Colorado.
14. Designs for wall paper decorations. Flower scroll, designed by A. F. Brophy. Strap ceiling, designed by G. A. Audsley. Arabesque panel decorations, paper for staircases, designed by Lewis F. Day.
15. Perspective and floor plan of an attractive carriage house in the Queen Anne style. Cost, nine hundred and fifty dollars.
16. Miscellaneous Contents: Something for architects and builders to remember.—Interior finish.—Sketch of Nathaniel J. Bradlee.—Colored decoration of churches.—On estimating.—Crushing of masonry.—The oldest architectural drawing.—Mahogany.—Flexible foundations.—Treatment of the ceiling.—The teredo.—The oldest timber.—Compressive strength of bricks and piers.—Repetition of ornament.—The Thomson-Houston electric system for street railways, illustrated.—An excellent system of heating.—The Ball high speed engine.—Beading, rabbet, slitting, and matching plane, illustrated.—The Sturtevant system of heating and ventilating, illustrated.—H. W. Johns' liquid paints.—Soapstone laundry tubs and kitchen sinks, illustrated.—Carpenter's vise, illustrated.—Metallic hip shingles, illustrated.—Corrugated iron lath.—Weather vanes, roof ornaments, etc.

The Scientific American Architects and Builders Edition is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming, practically, a large and splendid MAGAZINE OF ARCHITECTURE, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interesting examples of Modern Architectural Construction and allied subjects.

The Fullness, Richness, Cheapness, and Convenience of this work have won for it the LARGEST CIRCULATION of any Architectural publication in the world. Sold by all newsdealers.

MUNN & CO., PUBLISHERS,
361 Broadway, New York.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

All books, app., etc., cheap. School of Electricity, N.Y.

For Sale Cheap—Canada patent. Revolving flower stand. Cheap to manufacture. H. L. Starks, Preston, Conn.

Business Chance—Martin's Paving Process makes the contractor $15 to $40 per day. Agents wanted everywhere. E. L. Martin, Decatur, Ill.

Announcement.—"Centennial Day," April 30, 1889, being a legal holiday, our factory will not be run; but we shall have our works open for inspection all day. We extend an invitation to our friends, customers, and others interested to give us a call on that day and inspect our plant at our new location, Laight and Canal Streets. E. E. Garvin & Co.

Practical Books—Leading books on electricity and mechanics. List free by mail. Jas. Moore, N. W. corner Second and Race Streets, Philadelphia, Pa.

Steel name stamps (1-16, 3-32, or ⅛ in. letters), 15c. per letter. F. A. Sackmann, 16 Huron St., Cleveland, O.

For the latest improved diamond prospecting drills, address the M. C. Bullock Mfg. Co., Chicago, Ill.

Wanted—Superintendent to take charge of a woodworking machinery manufactory. Must be versed in designing, pattern making, and the handling of men. Address Indiana Machine Works, Fort Wayne, Ind.

For best casehardening material, address The Rogers & Hubbard Co., Middletown, Conn. Send for circular.

Water purification for cities, manufacturers, and private users. The only successful legitimate system. Hyatt Pure Water Co., 16, 18 & 20 Cortlandt St., New York.

Ball Engine.

Automatic cut-off. Ball Engine Co., Erie, Pa.

For the best Hoisting Engine for all kinds of work, address J. S. Mundy, Newark, N. J.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Perforated metals of all kinds for all purposes. The Robert Aitchison Perforated Metal Co., Chicago, Ill.

The Holly Manufacturing Co., of Lockport, N. Y., will send their pamphlet, describing water works machinery, and containing reports of tests, on application.

No. 11 planer and matcher. All kinds of woodworking machinery. C. B. Rogers & Co., Norwich, Conn.

C. E. Billings' Patent Surface Gauge. Drop Forgings. Bronze Forgings. Billings & Spencer Co., Hartford, Conn.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Friction Clutch Pulleys. The D. Frisbie Co., N. Y. city.

"How to Keep Boilers Clean." Send your address for free 96 p. book. Jas. C. Hotchkiss, 120 Liberty St., N. Y.

The best Coffee roasters, coolers, stoners, separators, polishers, scourers, glossing apparatus, milling and peaberry machines; also rice and macaroni machinery, are built by The Hungerford Co., 68 Cortlandt St., N. Y.

Lathes for cutting irregular forms. Handle and spoke lathes. I. E. Merritt Co., Lockport, N. Y.

Automatic taper lathes. Heading and box board machines. Rollstone Machine Co., Fitchburg, Mass.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

NEW BOOKS AND PUBLICATIONS.

PUBLICATIONS OF THE LICK OBSERVATORY OF THE UNIVERSITY OF CALIFORNIA. Edward S. Holden, LL.D. Vol. I. 1887. Sacramento: State Printing Office. 1887. Pp. 312. With illustrations.

This elegant quarto brings the story of the work of the Lick Observatory up to a recent date and leaves the ground clear for annual publications that shall keep its achievements more promptly on record. It gives the history of the founding and building of the observatory, the description of its buildings and instruments, and details of the work done from 1880 to 1885. The large telescope is of course not included, the contract for its construction only being given. Among the meteorological instruments illustrated, we notice the counterpart of the SCIENTIFIC AMERICAN registering barometer. The early observations, astronomical and meteorological, are given, together with elaborate tables of contents. The instruments described are illustrated by a number of well executed cuts, and a view of Mount Hamilton forms the frontispiece. The publication reflects much credit on Professor Holden, who edited it, and is a happy augury for the future.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(705) R. M. P. asks: 1. Can you tell me what substances other than benzine and bisulphidecarbon will dissolve sulphur and paraffine? A. You can use as solvents fixed oils, such as olive oil, petroleum, turpentine, and benzole. The sulphur will be apt to separate out at ordinary temperatures, however, from

© 1889 SCIENTIFIC AMERICAN, INC

solution in fixed oils. 2. Can you direct me to good dust arresters or separators? A. Dust can be separated by passing the air or fumes through fines of large area, or into large chambers, or by drawing them through muslin bags, as in zinc white factories. For electrical condensation of smoke or dust, we refer you to the SCIENTIFIC AMERICAN, vol. liv., pages 255 and 389. 3. Will sulphur combine with any oils? A. Sulphur combines with olive oil, on heating, producing a decomposition product formerly used in medicine and called oil of sulphur. You will find it described in the United States Dispensatory. 4. In what does paraffine oil differ from solid paraffine? A. In chemical composition; the oil contains more hydrogen and less carbon than the solid paraffine.

(706) W. L. P. asks for the most approved receipt or formula for germinating the alcoholic yeast plant. A. The plant is called *Saccharomyces cerevisiæ*. A sample of yeast must be procured which examined microscopically shows a fair proportion of the characteristic cells. A quantity of brewer's wort is sterilized by boiling, and to test its sterility is allowed to stand some days in a tightly closed vessel. If no fermentation occurs, a speck of the yeast is introduced on a platinum wire into wort prepared as above and the flask is at once closed. This gives a new growth of cells, and the process is repeated with fresh sterilized wort, the new growth being used for inoculation. The process can be repeated a number of times, each time conducing to purity. The process was devised by Pasteur, and can only be carried out by careful attention to all the precautions used by bacteriologists. A temperature ranging from 70° to 80° F. should be maintained during the experiment.

(707) H. F. S. — Your hydroquinone developer prepared as follows:

Sulphite sodium	400 grains.
Distilled water	10 oz.
Hydroquinone	100 grains.
Carbonate of potash	300 grains.

turns dark because of the oxidation by contact with the air and the presence of the potash. The developer will have more power and work quicker if you dissolve the potash separately and keep it in another bottle. Dissolve 300 grains of potash in 10 ounces of water. To develop, take one ounce of the hydroquinone and sulphite solution and one ounce of the potash.

(708) H. R. S. asks for a toning solution.

A.	Chloride of gold	15 grains.
	Acetate of soda	1 oz.
	Distilled water	15 oz.

One ounce of the above will tone one sheet of paper 18 by 22, and the solution should be prepared one week before required. When diluted for use, it should be used immediately, as it will not tone more than once. Before putting the print in the solution, pass it through a weak solution of plain carbonate of soda and water, which removes any acid in the paper, and allows the toning to proceed rapidly. For blue prints. Prepare:

A	Ammonia citrate of iron	4	oz.
	Water	14	"
B	Ferrid-cyanide of potassium	2½	oz.
	Water	15	"

Mix equal parts of A and B, filter, and coat the sheet of paper with a broad camel's hair brush. The film should be quickly dried. After printing, immerse in water for a few minutes, which will fix the print. To prevent cockling of prints, use the following mounting solution:

Nelson's No. 1 photo-gelatine	4 oz.
Water	16 "
Glycerine	1 "
Methylated alcohol	1 "

Dissolve the gelatine in water, then add the glycerine, and lastly the spirit.

(709) B. E. K.—A very good enamel collodion is made as follows:

Alcohol	½ oz.
Ether	½ oz.
Gun cotton	6 grs.

No castor oil need be added. If the plate is rubbed over with considerable French chalk, and the latter rubbed off, and the collodion flowed on, it will readily strip when dry. After the collodion is set, the print should be pressed down upon it. When dry, it will strip off from the glass. No gelatine solution is required. For additional particulars write to the Eastman Dry Plate and Film Company, Rochester, N. Y. It is better to mount the print on a thin card first, then mount all on the regular mount.

(710) E. W. G.—To tone blue prints an olive green or brown color, after washing immerse them in a bath made as follows:

Borax	2½ oz.
Hot water	38 oz.

Acidify with sulphuric acid until blue litmus paper turns red, then make the solution alkaline again by adding liquor ammonia until red litmus paper turns blue. Finally add 150 grains of gum catechu, occasionally stirring until it is dissolved. The bath will keep for any length of time. Tone until the color is right by reflected light.

(711) G. J. B.—See the "Amateur Photographer," by Ellerslie Wallace, $1, and Abney's book on "Photographic Emulsions," $1, which can be had from our book department.

(712) A. H. W. asks whether an ocean steamship can remove her propeller shaft and replace it by an entirely new shaft (provided she had an extra shaft on board) while at sea. A. It is possible, but we never heard of its having been done.

(713) C. C. R. asks: What liquid will be converted into vapor with the least heat, or, in other words, if economy was not taken into account, what fluid or liquid would do the most work with the same heat used in a boiler and engine? A. There is little difference in the latent heat of vaporization of water and other liquids referred to equal volumes of vapor. Economy is to be found in working in accordance with the second law of thermo-dynamics, by having as great a difference as possible between the lowest and highest temperature of the liquid used and of its vapor as used in the engine and boiler.

(714) A. T. C. writes: I wish to know which book explains the indicator card and the indicator, and the cost of the latest improved indicator? A. We can supply you with "Twenty Years with the Indicator," by Thomas Pray, Jr., in two volumes. Price $3. Also "Indicator Practice and Steam Engine Economy," by Hemengway. Price $2. For dealers in indicators, gauges, etc., consult our advertising columns.

(715) W. J. K. asks: 1. In making the simple electric motor described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641, I only put 11 coils on the armature; will that cause the machine not to run? A. The machine will run, but not to advantage. 2. Will soft Swedish iron wire do for the armature core? A. It will answer, but not as well as soft iron wire. 3. With what number of wire should it be wound to adapt it to the Fuller bichromate battery? A. The winding is right for the Fuller battery, provided the battery is connected up so as to furnish a current of sufficient quantity. 4. How many cells of the Fuller battery will it take to run a sewing machine? A. It will require about 18 cells. 5. How many to develop the full power of motor? A. Probably double the above number. 6. How should the cells be connected? A. Two in parallel and nine in series. 7. In the eight-light dynamo described in No. 600, SCIENTIFIC AMERICAN SUPPLEMENT, how is the machine attached to the base? A. By tap bolts running up through the base into the poles of the magnet. 8. If I wish to use it always to run incandescent lights, how should it be wound to give the best results? A. It should be compound wound series and long shunt. (See diagrams in the article describing the dynamo.) 9. Could say four of the lights be burned at one house and four others at another house a quarter of a mile away? If so, what size wire should I use to convey the electricity? A. It would be impracticable to use this dynamo in that way. 10. Can cast iron washers be used on the armature core? If so, how thick should they be to give best results? A. Cast iron washers will not be satisfactory. 11. What is the weight of the wire on armature? A. Refer to the article describing the dynamo. 12. What would be the best battery to run the above as a motor? A. Probably the plunging bichromate battery.

(716) C. J. M. writes: 1. How can I make a comparative test with reference to the candle or light-giving power of different grades of kerosene? A. Place a rod vertically on a table, with a smooth white sheet of paper on the table in front of it. Place two lamps identical in construction, each with sample of one of the oils in it, back of the rod and about one foot apart. They will cast two shadows of the rod. Move one or the other back and forth until both shadows appear of equal intensity. Then the light given by each lamp will be in proportion to the square of its distance from the rod. The oil consumed should be so adjusted as to be the same in each lamp. The best you can do is to weigh each lamp before and after the experiment, and thus determine the true consumption, and correct by inverse proportion, with allowance for specific gravity; but for any accuracy the consumption by measure must be identical, as this correction is only approximate. Of course you can measure the oil instead of weighing it. 2. Also the flashing point. A. For flashing point heat the oil in a cup immersed in a saucepan or other vessel containing water. Suspend an accurate thermometer with its bulb immersed in the oil. Gradually heat the water, and from time to time sweep a minute flame over the surface of the oil. When a flash is produced, note the thermometer. The best flame is a gas flame burning from a fine aperture at the end of a glass or other tube. Broom straws may also be used, or fine splinters of wood. You will find this test easier than the determination of candle power.

(717) J. S. writes: In casting pots and other hollow ware, it happens now and then that the iron cuts into the sand of the core and throws it against the cheeks or cope of the flask, and the pot or casting will show a lump on the inside and a corresponding depression on the outside. Of course, the casting is rejected. Now, what is the cause of this "scab"? Is it the sand? Sometimes for months not a scab appears, and all at once all the workmen are annoyed by them. A. The scabbing of the sand is sometimes caused by what is called "weak sand," or sand that has been used too long without adding new sand. It may also be caused by the sand being too wet or rammed too hard. It generally occurs where the metal strikes the sand as it leaves the gate, the scab floating against the cope side. Sometimes too hot metal will cause scabs. Hard ramming confines the steam in the sand, against which the hot metal impinges, causing a scab to burst away and float against the cope sand.

(718) B. B. L. writes: Will you please inform me what is the best solution for hand grenades to extinguish fires? A. Use bicarbonate of ammonia and sulphate of soda in strong solution.

(719) A. S. R.—Wrought iron expands more than cast iron with the same increment of heat. There is no perceptible difference in expansion with or across the grain. Platinum expands the least of the well known metals, by heat.

(720) E. F. S. asks: 1. Will the simple electric motor described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641, April 14, 1888, be large enough to run a boat fifteen feet long, 42 inches wide, drawing 10 inches of water when loaded? A. The motor will run a boat of that length. 2. How large should screw be for boat size of above? Should it be three or four blades? A. Use a two-bladed screw of 8 inches in diameter.

(721) S. E. K.—The magnetic variation of the needle for any given place varies from year to year; new surveys require correction for compass bearings. For western New York the annual variation is increasing and westward, amounting to about 6½ minutes each year.

(722) M. L.—You can obtain better results about as quickly by forcing, by compressed air, a small quantity of magnesium powder upward through a flame of alcohol than by mixing the powder with other compounds. The magnesium is more actinic than any substance you can mix with it, and will flash as rapidly. If you have difficulty in flashing quick enough, make one or two preliminary flashes until you sitters become accustomed to the light. The effect of closed eyes is due to the reflection of the light from the eyeballs.

(723) "Courier" writes: Can you tell us of any preparation of paste which will make labels adhere to tin? A. (*a*) Use a freshly made solution of gum tragacanth in water. (*b*) Make a paste of rye flour and glue, and to each pint add ½ ounce each of linseed oil and turpentine. (*c*) Soak 5 parts glue in 20 parts of water for a day, add 20 parts rock candy and 3 parts gum arabic, and dissolve by heating in a glue pot.

(724) G. R. asks for the recipe for making paste for bill posters' use. A. Use rye flour added a little at a time to boiling water to a good working thickness. If to be kept add a little oil of cloves, and for extra adhesiveness a handful of glue may be added to each pailful while still hot. The heating must be done carefully, to avoid burning.

(725) Amateur Photographer.—The compound will not produce a photographic light. The simplest device is to blow 15 grains magnesium powder upward through a flame of alcohol. There are several lamps on the market for this purpose.

(726) L. M.—The lowest fluid temperature alloy made from metals that are solid at ordinary temperature melts at 150° Fah., and is made by mixing 12 parts tin, 25 parts lead, 50 parts bismuth, 13 parts cadmium. This melting point can be reduced to 130° by adding 2 parts mercury.

(727) J. M. W. asks how many lamps of eight-candle power would simple electric motor run if turned into a dynamo. A. Probably not more than one or two.

(728) E. G. H. asks how the phosphorescent substance known under the name of Canton's phosphorus is prepared, also give name of books treating upon or referring to phosphorescence, stating where said books may be procured. A. You will find the subject of phosphorescence treated in the manuals of physics and in treatises on light. We also give you as references the following: SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 229, 497, 539, 249. Canton's phosphorus was made by igniting in a covered crucible at a strong heat sifted calcined oyster shells 3 parts, sulphur 1 part.

(729) A. M. asks: 1. What is a prime conductor? A. The prime conductor is the portion of an electric machine which receives the charge from the generator. 2. Can a motor be driven by a current derived from an electric Leyden jar? A. Static electricity is not adapted to the driving of motors. Rotary motion may be produced by the static discharge, but the power developed is very slight. 3. Could a discharge be derived from a Leyden jar coated with silver or gold leaf instead of tinfoil, and would the electricity be stronger by so coating? A. A discharge would be obtained. The material of the coating has little effect upon the charge.

(730) T. J. F. writes: 1. What is the best varnish to use with bronze powder so as to make a liquid gold solution? I have tried copal, shellac, and sandarac and mastic in methylated spirit, but in a short time verdigris appears and spoils the mixture. I want to keep it bottled up ready for use. A. For bronze powder varnish, see answer to query 378, in SCIENTIFIC AMERICAN of February 23, 1889. 2. How can I harden and temper small thin circular saws, from an inch diameter, so as to keep them perfectly flat? A. The plates are heated to a light cherry red and plunged into a bath of whale oil, resin, taliow, and beeswax. They are rubbed off with sawdust, and are very brittle and full of buckles. They are placed between tempering dies, hot plates pressed together by hydraulic pressure, and flattened while thus heated until the temper is drawn to a blue. This flattens them permanently, but after this they are generally hammered to equalize the tension. The operation is described in the manuals, such as "Grimshaw on Saws," $4.

(731) T. A. asks whether all manufacturers of dynamos use double-covered copper wire or single, and why. A. Both kinds are used. The double-covered is preferable in most cases, as the heavy covering prevents short-circuiting.

(732) G. T. B. asks: 1. What is the specific gravity of kerosene oil? A. 0·730 to 0·850. 2. What effect will water or oil have on a steel or brass spring if immersed for a considerable length of time in either? A. Oil will have but little effect. If a vegetable oil, it may tend to corrode steel a little. Water will oxidize steel, but will not affect brass.

(733) W. N. asks for the best composition of glue etc., for casting plaster ornaments. A. Use glue, water, and molasses made up as for printers' rollers.

(734) A. M. K. asks: What ingredients are used in making a light-colored furniture polish? A. Mix 1 pound olive oil, 1 pound oil of amber, 1 ounce tincture of henna.

(735) T. H. L. asks: Are aniline inks simple solutions of the desired color, or is gum or any other substance added? How many grains should be added to a quart of water to make a good ink? A. They are simple aqueous solutions; 1 part of the desired aniline color is enough for 80 to 200 parts of water, different colors having different intensities. If desired, 1 part of dextrine may be added to 100 parts of the fluid. Do not use gum arabic.

(736) G. A. F. asks for a recipe with correct proportions of ingredients for making a good liquid glue such as bookbinders use in the manufacture of tablets. A. For 50 lb. of the best glue (dry) take 9 lb. glycerine. Soak the glue for ten minutes and heat to solution and add the glycerine. If too thick, add water. Color with aniline dissolved in alcohol.

(737) J. M. W. asks how to take a stain or bright spot out of a carpet, made by spilling sal soda on it; it was a preparation of sal soda and water for developing pictures, and when we tried to wash it out, it became brighter. A. We fear the stain is ineradicable. Possibly vinegar might restore it. All depends on what the dye was which was affected, and no remedy can be given that will work for all conditions.

(738) J. W. E. writes: 1. Will you inform me whether there is any way of ascertaining the weight of cold air in a small space, say 1 in. square? A. To make the determination directly requires very delicate apparatus and considerable manipulative skill. 100 cubic inches of air at 60° F. and 30 inches barometer weigh 30·935 grains. 2. Also the difference in weight between hot and cold air, if any, and the weight of each in the above space? A. As a gas is increased in temperature it expands $\frac{1}{491}$ of its volume at 32° F. for each degree of elevation, and hence a given volume weighs less as the temperature rises, if the pressure is constant. Thus a cubic inch of air at 32° F. would weigh nearly 32¾ grains.

(739) E. L. W. asks: 1. In making a plunge battery as described in SUPPLEMENT, No. 157, to be used for a small electrotyping outfit, which plates would give the best results—the silver or carbon? A. Carbon is the best for a plunging battery, but we would not recommend a plunging battery for electrotyping. Better use a large Bunsen battery. 2. Should the carbon of one cell be connected with the zinc of the other, and so on? A. Should you determine to use the plunging battery for electrotyping, it would probably be better to connect all the zincs together and all the carbons together.

(740) C. F. W.—A galvanometer is of little value in measuring secondary currents of high intensity. Probably the best way to ascertain the strength of a secondary current is to measure the length of the space it is able to leap across.

(741) F. P.—The years 1700, 1800, and 1900 are not leap years, as arranged in the Gregorian calendar. This arrangement makes the integral day division of the year through the centuries with the least possible error.

(742) H. L. asks: Of what kind of iron are the rings of the armature core in the 8-light dynamo made? Are the pins that secure the series of rings and wooden core to the shaft insulated, and how, or are they wood? A. The rings of the armature are made of wrought iron. It is not necessary to insulate the pins. They are put straight through the armature rings and the shaft.

(743) H. B. M. asks how to kill blue grass growing between bricks around the lawn? A. Wash the bricks with salt water or strong solution of soda.

(744) F. A. writes: In making electric motor as described in SCIENTIFIC AMERICAN, March 7, 1888, No. 16 cotton-covered wire is rather hard to work; would not the ordinary office wire be sufficient. If not, please state for what reason. A. You may use No. 18 cotton-covered wire on the armature of your motor, if you prefer to do so. Office wire will not answer on account of the thickness of its insulation. It will not admit of winding the required amount of wire in the allotted space.

(745) G. B. asks: 1. If better results would be obtained by using two wires wrapped side by side in the primary coil of an induction coil? A. The second wire would not improve the results. 2. Does the intensity of the secondary current depend on the extent to which the core is magnetized? A. Partly upon the magnetism of the core, and partly upon the length of the secondary. 3. Could the current produced by a magneto-electric machine be utilized in running another machine of nearly the same size and construction? A. This could be accomplished by using a commutator to convert the current from an alternating to a direct current. 4. What is the best and cheapest way to construct an induction coil to give a spark an inch and a half in length? A. For information on the construction of induction coils, consult SUPPLEMENT, No. 160.

(746) R. H. S. asks how he can make liquid hydrofluoric acid, and what is there he can rub over the etching so as to make it more distinct? A. Distill a mixture of 1 part fluorspar and 1½ parts sulphuric acid in a lead retort, collecting the distillate in water. It may be concentrated by distillation from a platinum retort; water first comes off, and afterward the stronger acid. It must not touch glass or silica. To make etched marks more distinct, rub the surface with dry cinnabar or Venetian red and polish with a dry cloth. It is a very dangerous material to work with, and it is better to buy it ready made.

(747) C. F. H. writes: Will you kindly inform me through your paper how I can soften a hair brush which I have, and which is too stiff for use? It being a very good one, I thought I might be able to soften it instead of going to the expense of another. A. Try washing it in water containing 10 to 25 per cent of glycerine.

(748) E. G. asks: 1. Will a paraffined wooden tub do for outer vessel in SUPPLEMENT, No. 149, battery? A. We recommend porcelain or glass. 2. Give connections in Bell telephone armature. A. See SUPPLEMENTS on subject, especially 142 for telephone and 167 for calling mechanism.

(749) H. P. asks: 1. If quicksilver is compressed, and confined securely in a 1-16 inch thick brass shell, and such shell containing it be subjected to a white heat, would the mercury expand sufficiently to fracture the shell? A. It would amalgamate with the brass and destroy it without the application of heat. If steel, iron, or platinum were used, with which mercury does not easily amalgamate, it would burst the envelope unless it were exceedingly thick. The force exerted by a solid or a liquid in expanding is almost irresistible. 2. Which of the acids is it that is found in green gooseberries, sorrel, rhubarb, etc.? A. It is largely citric acid. 3. What quantity of chlorine would I require to bleach about 14 lb. of shellac at a time? Would it be as cheap to purchase the chlorine as to make it; I have stills and apparatus for all purposes. A. Rub 2 lb. bleaching powder to a paste with water, strain through linen, and wash residue with 2 pints of

© 1889 SCIENTIFIC AMERICAN, INC

water. To filtrate and washings add a solution 1 part of potash in 3 of water until no more precipitate forms; filter. Two pounds of the shellac must previously have been digested in one gallon of strong alcohol. To this add, with constant stirring, the bleaching solution. After half an hour's standing add enough hydrochloric acid to give an acid reaction. The shellac is precipitated, and must be washed and kneaded in hot water until the water passes off clear. It is then dried in the air. The filtrate may be neutralized by addition of caustic soda, and the alcohol may be recovered from it by distillation. 4. What wood is methyl alcohol made from which is used for polluting spirit into methylated spirits? A. Oak wood gives good results, though any wood may be used. 5. Does not the electric current, when passing a long a copper wire, pass through the exterior of the wire for its course in prefereuce to the core of the wire, or equally throughout the wire? A. Under ordinary conditions (dynamic electricity) equally throughout the wire. 6. Has it ever been decided that the electric current flows only in one direction when in complete circuit, and that it is from negative to positive pole? A. No. There is no flow except as a matter of convenience in nomenclature. 7. Would a new departure in carbons (for street lamps), which would yield twice the amount of light given by those now in use (with the same dynamo power), be advisable, even though such new make of carbons lasted only half time the present ones do, and cost the same at first? A. It might seem doubtful, because the great desideratum is to have carbons last a long time. But the line indicated seems so hopeful a one that it would probably well repay work and investigation. 8. I notice sheets of [mica are never used for photographic plates for negatives; is there any good reason that unfits them for preparation for that purpose? A. They are rarely clear enough, and if large are very expensive, and are also friable. 9. How could I silver fluted and convoluted glass articles with quicksilver? I manage sheet glass all right after the old method, but fail with irregular surfaces; is there any way of brushing it on to the glass in the shape of a sort of mercury paint? A. See query 438, SCIENTIFIC AMERICAN, March 16, 1889. 10. I wish to cut or turn a hole with radiated grooves through a block of boxwood, not a screw worm hole, but a sort of ratchet cycle groove, each groove to be uniform. How could I do so? A. This you might do with a hand tool, groove by groove, or cut a special cbaser with straight cross-cut teeth. 11. What is the rule followed for sighting rifles? I have two of different makes; the foresight on one is merely a pin's head and the back sight very low for 200 yards; whereas in the other the foresight is a semi-disk standing up quite an inch, with a back sight also very high. I can score equally as well with either, at 200 yards. A. The shape of rifle sights is largely a matter of personal preference. Certain forms are generally considered more accurate than others, and sometimes may be "barred" or disallowed in matches.

(750) G. S.—The soldering liquids are for making a perfect contact of the metals and their easy flow. Heat of a soldering copper is necessary for melting the tin and flowing it upon the surface.

(751) A. B. asks: Is there any way to prevent the corrosion of the connections of the carbons of a Grenet battery? A. Heat the ends of your carbons and apply paraffine, allowing it to soak well into the carbon. This will prevent the solution from reaching the electric connection of the carbon. Care should be taken to prevent the paraffine from reaching the portion of the carbon which extends into the solution.

(752) B. F. A. asks: When a weak solution (say 1 to 2 per cent) of copperas, protosulphate of iron, is mixed with decaying vegetable or animal matter, what are the principal reactions that take place? I notice that copperas is an effective deodorizer, but do not understand its action. A. Your question is a difficult one. Offensive putrefaction is due largely to germs and low forms of bacterial life. Copperas is poisonous for these organisms, and so prevents decay.

(753) H. W. D.—So many young men are entering the field of electrical engineering, that you will find it very hard to find a position. You should be willing to take any place that is in the electrical department, even if it is merely in charge of lamps or in the dynamo room. Wages will be low, work perhaps disagreeable to you, and the working up process will depend partly on your own activity and knowledge of the science and partly on opportunity. You will be in competition, moreover, with technically educated men. Having secured a place with some company, you should read and study assiduously. The addresses of companies can be procured from electrical journals' advertising pages.

(754) A. E. S.—Make your magnet cores of soft iron three-eighths of an inch in diameter and one and one-quarter inches long, and wind the cores to the depth of the diameter of the core with No. 24 wire. We think that with a magnet of this kind you will have no further trouble with the bell.

(755) R. M. asks: 1. Will the dynamo explained in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 161, run incandescent lamps? If so, how many and of what power? A. It will run three five-candle power lamps of low resistance. 2. Would the current running through a one-eighth inch bare wire on a circuit of 1½ miles, lighting about 200 Edison 16 candle power incandescent lamps, be strong enough to cause death if a person should take hold of one of those wires? A. Probably not, but we would not advise the handling of such wires.

(756) W. N. B. writes: In producing an electric light of ⅛ to 1 candle power, would it not be less expensive at the end of a year to use an induction coil with one or two good cells of battery than to use a large power of battery alone? I wish to produce enough light to illuminate the front of a safe just so it will be visible during the night. A. You would gain nothing in economy by the use of an induction coil in the manner proposed. The only advantage of an induction coil in electric lighting is in the distribution of the current. It permits of using a current of high potential on the line wires, and of reducing it at the point of use to a current of low potential suitable for incandescent lighting. We think it would be better if you were to employ a few cells of gravity battery and a storage battery.

(757) H. L. H.—For making emery wheels see SCIENTIFIC AMERICAN SUPPLEMENT, No. 125. 2. For preserving paste add a little alum water, 3 per cent, or a few drops of carbolic acid. Salicylic acid is also an excellent preservative. 3. For black dye for leather: Boil 3 pounds logwood chips, ½ to 1 pound fustic shavings, in 1½ gallons water; boil, filter, and apply to the surface of the leather. Then apply a wash solution of sulphate of iron. Dress the leather with oil or varnish as required. 4. For a quick-drying clear varnish use mastic dissolved in ether, or to make your shellac varnish clear, dissolve fine shellac in wood alcohol and allow it to settle in a bottle and decant the clear varnish. The muddy varnish is too thick for lacquer work. It is made for painters' use.

(758) L. J. writes: A ball falls 64 feet from the mast of a moving ship to the deck. During the time of the fall, the ship moved 24 feet. Represent the actual path of the ball. Find its length. A. The ball will fall vertically from the mast to the deck, as a plumb line would hang, save variation by the wind. In relation to a stationary vertical line, the path of the ball would be parabolic, having the vertical line at the moment of starting as the axis, with the acceleration of fall and the motion of the ship as co-ordinates. By working out the co-ordinates for moments of flight you will obtain the true length of the curve.

☞ Books or other publications referred to above can, in most cases, be promptly obtained through the SCIENTIFIC AMERICAN office, Munn & Co., 361 Broadway, New York.

TO INVENTORS.

An experience of forty years and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

April 9, 1889,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Advertising cards, preparing designs for, T. P. Heinemann 401,164
Advertising device, Goodwin & Chase 401,158
Agricultural implement, R. Owen 401,297
Armature for dynamo-electric machines, E. Thomson 400,973
Armature for electro-magnets, J. Geary 401,152
Auger, post hole, N. Newman 400,939
Automatic gate, W. H. Miller 400,935
Automatic gate, J. C. Rock 400,952
Awning frame, C. M. Ashby 401,164
Axle, car wheel, G. W. Jones 401,280
Baby jumper, A. W. Gray 401,266
Back and leg brace, J. H. Smith 401,228
Bag. See Feed bag.
Baling press, W. H. Heffley 400,912
Baling press, W. J. H. Knappe 401,171
Baling press, J. La Dow 400,922
Bar. See Pinch bar.
Bars or rounds of steel or iron, manufacture of, S. McCloud 400,931
Basket cover fastening, fruit, F. Burns 401,002
Battery. See Galvanic battery. Secondary battery.
Bed bottom, spring, J. M. Davis 400,900
Bell, electrical call, J. G. Noyes 401,296
Belt fastener, J. B. Norton 401,201
Bicycle, D. A. Babe 401,105
Bin. See Flour bin. Wine bin.
Blast furnaces, flux feeding apparatus for, N. A. Pratt 401,063
Block. See Paving block. Tackle block.
Board. See Wash board.
Boiler for heating purposes, I. B. Potts 401,300
Book and hook cover, I. Reed 401,210
Book case, R. W. Lovering 400,925
Book, memorandum, M. F. Berry 401,115
Book, pocket check and form, E. Fanning 401,324
Book support, J. W. Coultas 401,011
Boot or shoe, B. A. Pillow 401,060
Boot or shoe, rubber, E. F. Bickford 401,246
Bosom form, J. W. Greene 401,028
Bottle necks, tool for forming, W. A. Caswell 400,898
Bottle stopper, S. Marks 400,927
Bottles, means for facilitating the opening of internally stoppered, Barrett & Varley 400,892
Box. See Paper box. Work box.
Brace. See Back and leg brace. Drill brace.
Brake. See Car brake. Vehicle brake. Wagon brake.
Brake handle, S. A. Burns 401,003
Bread raiser and kitchen safe, combined, D. Pentz 401,055
Brick, T. Thorn 400,974
Brick, incrusting, J. C. Anderson 401,098
Brick kiln furnace, C. M. Keep 401,172
Bricks, etc., incrusted with metal, J. C. Anderson 401,097
Buckle, D. B. Baker 400,891
Building blocks or paving tiles, frame for, B. W. Belden 400,996
Bundle carrier, F. Hickmann 401,032
Burner. See Gas lighting burner. Hydrocarbon burner.
Butter mould, H. I. Carver 401,130
Butter worker, H. I. Carver 401,129
Button, G. H. Thomas 401,084
Button, campaign, Winterdorf & Reymond 401,094
Cable, wire, Batchelor & Latch 401,112
Calorimeter, steam, G. H. Barrus 401,111
Cam, A. D. Woodmansee 401,320
Car brake, H. N. Coffin 401,252
Car coupling, G. W. Campbell 401,251
Car coupling, M. M. Carmona y Valle 400,905
Car coupling, R. I. Hampton 401,160
Car coupling, C. A. McDougall 401,046
Car coupling, J. L. Monasmith 401,198
Car heater, Mead & Thomson 401,194
Car partitions, chain for stock, B. C. Hicks 401,274
Car, stock, J. R. Wilson 401,091
Cars, apparatus for heating railway, G. H. Benjamin 401,245
Cars, bearing for street, D. G. Grant 401,158
Cars, brake shoe attachment for railway, G. A. Diedel 401,257
Cars, heating street, W. H. Patton 401,205
Cars, lamp fixture and ventilator for railway, J. Williams *et al* 400,984
Cars, safety guard for railway, G. W. Remington 401,068
Carrier. See Bundle carrier. Harvester sheaf carrier.
Case. See Book case.
Caster, G. D. Clark 400,899
Casting S-straps, core for, J. Z. Gifford 401,026
Chain and uncoupling device therefor, door, H. Maul 400,930
Chair. See Oscillating chair. Switch rail chair.
Chute indicator, coal, J. Elder 401,140
Cigar bunching machine, S. A. Shepard 401,076
Cigar bunching machine, J. R. Williams 401,090
Cigar cutter and support, P. Kern 401,174
Cigar making machine, J. E. Smith 401,077
Cigar wrapping machine, S. J. Flatow 401,147
Circuit connecting device, J. C. Reilly 401,067
Cleaner. See Cotton cleaner. Window cleaner.
Clevis, awning, W. M. Brown 400,895
Clocks, electric winding for torsion pendulum, H. Rahe 401,065
Clother drier, C. D. Fuller 401,264
Clothes line support, J. T. Crane 401,253
Clutch and tension machine, automatic, J. C. Bill 400,908
Clutch, friction, King & Barnhart 401,176
Cocks, floor key for, J. Powell 400,944
Cocoa, preparing soluble, H. Stollwerck 401,311
Coffin plate, J. H. Spicer 400,963
Coffins, frame for the pillows of, C. Krauser 401,284
Commutator bars, fitting, F. Bailey 400,994
Conduits, leading-in apparatus for, J. A. Seely 400,958
Cone duster for fibrous substances, F. G. Sargent 400,953
Cooking apparatus, portable, H. Fricker 401,261
Cooler. See Water cooler.
Copper from copper pyrites, extracting, J. Perino 401,056
Corn husking implement, J. L. Culberson 401,012
Corset, F. E. Denzel 401,015
Cotton cleaner, seed, W. M. Wilson 401,092
Cotton gins, brush cylinder, I. F. Brown 401,124
Cotton picking machine, T. J. Gray 401,268
Coupling. See Car coupling. Pipe coupling. Thill coupling.
Crusher. See Ore crusher.
Cultivator, B. F. Berger 401,114
Cultivator, F. W. Kirkbride 401,178
Cultivator for listed corn, H. B. King 401,177
Cultivator, plow, etc., combined, A. B. McBride 401,045
Cup. See Sponge cup.
Cuspidor, D. H. Murphy 400,938
Cutlery handle, table, W. W. Lee 401,181
Cutter. See Cigar cutter. Harvester cutter. Tube cutter.
Damper, stove pipe, F. W. Hoefer 401,166
Desk or cabinet, W. H. Travis 401,314
Digger. See Potato digger.
Door spring, J. H. Williams 401,319
Dredging bucket, C. A. Morris 400,936
Dress form, A. McDowell 401 192
Drier. See Clothes drier. Fruit drier.
Drill. See Grain drill.
Drill brace, T. C. Massey 400,928
Dropper spout, S. P. Denison 401,256
Dye, yellow, E. Frank 401,024
Dyeing vat, J. W. Greaves 401,027
Educational apparatus, A. L. Manning 401,048
Egg beater, C. F. Pfau 401,058
Electric circuit testing device, M. Robinson 400,951
Electric engine system, reciprocating, C. J. Van Depoele 401,231
Electric lights, device for supporting and operating, Russell & Drake 401,304
Electric machine, dynamo, E. Weston 401,318
Electric machine, dynamo or magneto, E. Weston 401,317
Electric machine regulator, dynamo, C. J. Van Depoele 401,230
Electric meter, A. H. Manwaren 401,191
Electric meter, W. F. Smith 401,226
Electric motor, alternating current, E. Thomson 400,971
Electric motors, regulation of, F. Bain 400,890
Electrical conductors, apparatus for laying, W. F. Smith 401,225
Electrical conductors, conduit for, G. H. & K. C. Gillette 401,155
Electricity, system of transmitting and distributing, S. C. C. Currie 401,255
Electricity to propel vehicles, apparatus for the application of, F. Wynne 401,322
Electrodes for secondary batteries, preparing, W. Main 401,291
Elevator safety device, P. G. Backman 401,106
Embroidering machine frame, J. Frey 401,260
Engine. See Steam engine.
Engines, reverse link for steam, Snyder & Deets 400,960
Envelope and stamp moistener, A. J. Elias 401,141
Evaporating saccharine or other liquids, apparatus for, A. Young 401,238
Extension table, E. H. W. & H. W. Stahluth 401,310
Extractor. See Nail extractor.
Eye bars, die for upsetting, W. R. Webster 400,977
Fabric. See Fence fabric.
Faucet, self-closing, K. Maier 401,288
Feed bag, W. M. Brooke 401,001
Feed regulator for roller mills, J. W. Wilson 400,986
Feed trough, G. D. Burton 401,249
Feeder, calf, W. L. Spencer 400,962
Fence fabric, wire, B. Searles 400,954
Fence making machine, Parker & Landers 401,298
Fences, guard for barbed wire, M. B. Chappell 401,183
File, portable scrap, C. W. Taylor 400,968
Filtering apparatus, B. F. Perkins 401,057
Fire alarms, thermal circuit closer for, A. C. Iwanowski 400,917
Firearm, breech-loading, W. Anson 401,101
Firearm, revolving, D. B. Wesson 401,087
Fishing reels, line guide for, Moller & Raettig 401,049
Flour bin and sifter, T. F. Crary 401,254
Flushing urinals, etc., apparatus for, S. H. Wright 401,321
Frame. See Awning frame. Embroidering machine frame. Harvester frame. Spectacle frame. Spectacle or eyeglass frame. Spinning frame.
Fruit drier, F. Altman 400,933
Fuel magazine, Greene & Treman 400,909
Furnace. See Brick kiln furnace. Zinc furnace.
Galvanic battery, J. H. Phalan 401,059
Galvanometer, standard tangent, E. Weston 400,980
Game apparatus, H. L. L. Smith 401,222
Garment supporter, Boyle & Gates 401,121
Gas burners, apparatus for lighting, A. A. Lister 401,184
Gas engines, igniting apparatus for, L. C. & B. Parker 401,204
Gas lighting burner, electric, J. Geary 401,153
Gas pressure regulator, W. H. Metcalf 401,048
Gate. See Automatic gate.
Gate, C. Chiddister 401,008
Gate, J. H. Tudor 400,976
Gate, T. Tyson 401,315
Gearing, driving, J. C. Whitford 400,981
Gearing, frictional, G. F. Evans 401,018
Generator. See Steam generator.
Glassware, apparatus for shaping, J. Anderson 401,099
Glove fastening, W. S. Richardson 400,948, 401,070
Grain binders, band securing mechanism for, J. S. Davis 401,013
Grain drill, C. J. Fendel 401,022
Grain drill, J. W. Rhodes 400,947
Grain separator, H. Stoker 400,965
Grinding machine, W. S. Robbins 401,212
Grinding machine, surface, Hyde & Horner 401,278
Guard. See Snow guard.
Hair curler, F. Faust 400,904
Hair plucking machine, J. H. Brierley 400,894
Halter, J. Dunn 401,017
Handle. See Brake handle. Cutlery handle.
Harness hook, D. E. Kempster 401,173
Harrow, wheeled, McSherry & Swope 400,932
Harvester cutter, J. A. Blair 401,117
Harvester frame, R. Brown 401,127
Harvester sheaf carrier, L. W. Ellis 401,259
Hatchway, elevator, H. G. Hester 401,273
Heater. See Car heater.
Heating apparatus, electric, H. F. Watts 400,978
Heel burnishing machine, J. W. Carver 401,131
Heel protector, F. H. Richards 401,069
Hinge, W. S. Larimer 401,036
Hinge, J. A. Turner 401,086
Hoe blank, G. B. Ely 400,902
Holder. See Lamp holder.
Hook. See Harness hook. Snap hook.
Hotbeds, light bolder for, W. De Caux 401,137
Hub, wheel, E. C. Roberts 401,243
Hydrocarbon, apparatus, J. F. Seery 400,959
Hydrocarbon burner, J. Akin 400,889
Hydrocarbon burner, E. W. Fellowes 401,021
Hydrocarbon burner, W. L. Fisher 401,149
Hydrocarbon burner, A. F. Fletcher 400,905
Indicator. See Chute indicator. Power indicator.
Induction coil and self-inductive apparatus, E. Thomson 400,972
Induction machine, static, H. Glaser 401,156
Insulating and coating compound, A. De Figaniere 401,014
Iron. See Wagon box corner iron.
Jack. See Lifting jack.
Key blanks, manufacture of, C. M. Burgess 401,247
Knife. See Pocket knife.
Labeling machine, can, W. Lee 401,039
Lace pin fastening, M. E. Oppenheimer 401,053
Lampfilaments, manufacture of incandescent, T. D. Bottome 401,120
Lamp holder, piano, L. Pray 401,064
Lamps, attachment and oil filler for, J. G. Seltzer 401,075
Lantern, tubular, L. F. Betts 401,116
Last, J. Reeson 400,946
Latch, O. A. Jenison 401,169
Lath sawing machine, D. S. Abbott 400,991
Lawn tennis net, F. W. Taylor 401,082
Lid for receptacles, C. W. Elliott 400,901
Lifter. See Track lifter.
Lifting jack, J. A. Boice 401,119
Lightning arrester, E. Thomson 401,085
Lightning conductor for wire fences, F. E. Wood 401,095
Liniment, J. A. Achard 400,992
Lithographic and zincographic presses, damping apparatus for, A. Genet 401,025
Lock. See Nut lock. Seal lock. Trunk lock.
Locomotive, air and gas, A. Schmid *et al* 400,218
Loom, lappet, Hodges & Lonergan 400,915
Loop tie for decorative scarfs or similar articles, J. Muller 401,051
Mail pouch, C. W. Miller 401,196
Mat. See Metallic mat.
Mattress, pillow, etc., spring, A. J. Lytle 401,287
Mattress, woven wire, R. Preuss 401,301
Measuring stick, extensible, C. M. Mumford 401,292
Meat chopping machine, F. Bloomqvist 400,999
Mechanical and electro-magnetic motor, combined, C. A. Randall 401,207
Medical apparatus, electro, J. J. Lewin 401,041
Medicated felt, A. F. Machold 401,189
Metallic mat, A. M. Reeves 401,066
Meter. See Electric meter.
Middlings purifier, H. A. Barnard 401,242
Mill. See Roller mill.
Mould. See Butter mould.
Moulding machine, sand, W. E. Bird 400,893
Motion, device for converting, C. E. Armstrong 401,103
Motion from heat produced by liquid or gaseous fuel, obtaining, J. Hargreaves 401,162
Motion, machine for imparting, J. J. Iten 401,168
Motor. See Electric motor. Mechanical and electro-magnetic motor. Spring motor. Steam motor. Thermo-dynamic motor.
Musical instrument, automatic, T. A. Macaulay, 401,187, 401,188
Nail extractor, L. Baumeister 401,113
Nippers, S. E. Selleck 401,308
Nut lock, L. W. Evans 401,019
Nut lock, B. Marshall 401,044
Oil well bailer, T. A. Burkellow 400,896
Oiler, eccentric, J. & I. Roshong 401,072
Ointment, C. V. Sutherland 400,967
Optical device for the observation of localities by reflection, E. A. Trapp 401,229
Orange grader, A. Ayer 401,241
Ore crusher and metal separator, J. C. Wiswell 400,988
Ore feeder, G. Johnston 401,034
Ore roaster, C. J. Fendel 401,023
Oscillating chair, C. E. Whittlesey 401,089
Packing ring, renewable, H. R. Frisbie 401,262
Pail cover, G. Fuchs 400,903
Paint mixer, Schock & Wansbrough 401,306
Paper box, D. S. Clark 401,009
Paper, composition for waterproofing and preparing sheathing and building, Manahan & Gade 401,042
Paper machine, lace, G. Paci 401,054
Paper roll, toilet, O. H. Hicks 400,913
Paper roll, toilet or wrapping, S. Whesler 400,233
Pavement and paving brick, D. Harger 401,030
Paving block, R. B. Berrie 400,997
Perforating machine, S. D. Layman 401,048
Photographic printing frames, vignetting attachment for, J. R. Tewksbury 401,083
Pianos, key leveling device for, C. H. Smith 401,309
Picture, transparent, W. Read, Jr 401,303
Piles, etc., drive apparatus for, T. J. Harriman 401,031
Pinch bar, S. H. St. John 400,964
Pinion facing machine, Learned & Murray 401,180
Pipe coupling, G. N. Riley 400,949
Pipe trap, exhaust steam, T. Burkhard, Jr 401,248

© 1889 SCIENTIFIC AMERICAN, INC

Pipes, securing rigid sockets in rubber, A. D. Schlesinger 400,955
Plaiting apparatus, C. F. A. Roell 401,214
Planing machine, metal, G. A. Gray 401,267
Planing machines, pressure bar for, G. W. Passel. 401,290
Planter and drill combined, corn, A. J. Callaway .. 400,897
Planter, corn and cotton, T. J. Cathey 401,132
Plows, adjusting device for wheel, A. J. Ventzki .. 400,977
Pocketbook, E. Schnopp 401,219
Pocket knife, A. Wilzin 400,987, 401,093
Pot rest, J. McLean 401,193
Potato digger, J. W. Loree 401,285
Powder duster, poisonous, G. B. Titus 401,313
Power. See Water power.
Power indicator, E. Nixon 401,199
Power testing machine, coin operated band, Meady & Bosworth 400,933
Preserving fruit, W. R. Baker 401,109
Press. See Baling press.
Printer's press point, J. W. Meese 401,195
Processing apparatus, Hull & Hand 401,276
Protector. See Heel protector. Skirt protector.
Pump, rotary, J. H. Parker 401,203
Punch, F. H. Seibel 401,220
Rail, R. D. Bacot 401,107
Railway crossing signal, J. H. Young 401,323
Railway, electric, R. Luodell 400,996
Railway, electric, S. H. Short 401,221
Railway switches, interlocking device for, H. B. Potter 400,943
Railways, current collecting device for electric, R. M. Hunter 400,916
Receptacle for bundles, L. M. Rose 401,071
Regulator. See Electric machine regulator. Feed regulator. Gas pressure regulator.
Ring. See Packing ring.
Roller mill, H. A. Barnard 401,243
Roller mill, reduction, M. Mastas 400,929
Rope or cable, C. M. Thompson 400,970
Rubber, etc., production of material as substitute for India, F. Greening 401,269
Ruling machine, paper, J. C. Forman 401,151
Saddle, harness, J. W. Clark 401,134
Salt, apparatus for the manufacture of, H. Williams *et al* 400,983
Sandpaper device, S. Ross, Jr 401,215
Sash balance, spring, W. S. Jennings 400,918
Sash fastener, W. H. Murphy 401,208
Saw blades, etc., hardening apparatus for, S. T. Paul 401,206
Saw for cutting tenons, T. Forsaith 400,906
Saw jointer, W. A. Hunter 401,277
Saw or other steel blades, apparatus for hardening, T. S. Disston 401,138
Screw cutting die head, W. J. Baker 401,108
Seal lock, W. I. Ludlow 401,266
Seat. See Vehicle seat. Wagon seat.
Secondary battery, W. Main 401,289, 401,290
Seeder, J. W. Calef 401,128
Separator. See Grain separator.
Sewing machine buttonhole cutter, A. L. Traver .. 400,975
Sewing machine feeding device, L. Gundelach .. 401,271
Sewing machine feeding mechanism, F. T. Leilich 401,152
Sewing machine for finishing buttonhole pieces, G. S. Hill 400,914
Sewing machine needle vibrating mechanism, Muther & Woodward 401,294
Sewing machine tuck creaser or marker, J. M. Griest 401,029
Shafting, die for drawing, J. Rapp 401,208
Shawl strap, M. Rubin 401,075
Shears, W. P. Hatch 401,163
Sheet metal vessel, H. S. Reynolds 401,211
Shell, high explosive, S. H. Emmens 400,903
Shoe fastening, P. Caspary 401,007
Shoe sole, channeled, Wiggin & Bartlett 401,235
Shovel. See Sink shovel.
Signal. See Railway crossing signal.
Signaling apparatus, electrical night, E. Kaselowsky 401,035
Signs and advertising cards, producing variable, T. P. Heinemann 401,165
Sink shovel and cleaner, combined, P. C. Brown .. 401,126
Skimmer, milk, A. T. Mills 401,197
Skirt protector, Smith & Catterall 401,078
Snap hook, J. R. Ryan 401,305
Snow guard, T. O'Gara 401,202
Soldering machine, can, J. Brown 401,125
Spade or shovel, J. A. Little 400,923
Spectacle frame, J. E. Searing 400,957
Spectacle or eyeglass frame, J. E. Searing 400,956
Spindle driving bands, tension regulator for, P. L. Kenney 401,281
Spinning, doubling, and twisting machine, Kimmel & Claussen 401,282
Spinning frame, ring, J. T. Meats 400,934
Spinning frame, ring, Saltmarsh & Bogardus 401,217
Splicing device, J. C. Basel 401,244
Sponge cup and sealer, J. C. Parker 400,941
Spring. See Door spring. Vehicle spring. Vehicle side spring.
Spring jack switch, H. B. Thayer 400,969
Spring motor, A. Meahl 401,047
Spring motor, C. Nicholson 401,052
Stamp, time, B. B. Hill 401,033
Stamping sheet metal, roller die for, L. L. Sagendorph 401,216
Stanchion, W. Scott 401,307
Steam engine, compound, C. Holly 401,167
Steam generator, M. C. Armour 401,102
Steam generator, superheating, A. Young 401,239
Steam motor, low pressure, R. K. Evans 401,020
Steel balls, machine for making, W. H. Wright 400,980
Steel, toughening forged articles of, J. Coffin .. 401,010
Stool, hunter's portable, E. G. Purdy 401,302
Stopper. See Bottle stopper.
Stores, retail case and support for, G. W. Pyle 400,945
Stove, gasoline, W. P. Dunham 401,016
Stove, vapor, C. S. Drake 401,258
Stoves and other purposes, heater for, S. H. Attice *et al* 401,096
Strap. See Shawl strap.
Street sweeping machine, C. Weller 401,232
Supporter. See Garment supporter.
Suspenders, H. Lieberthal 401,183
Switch. See Spring jack switch.
Switch or circuit changer, W. W. Griscom 401,270
Switch rail chair, A. A. Strom 401,312
Syringe, J. H. Glasscock 401,157
Table. See Extension table.
Table cover fastener, Knapp & Thompson 401,283
Table or stand for exhibiting cloaks, etc., W. Bardsley 401,110
Tackle block, G. A. Ford 401,150
Tape measure, E. G. Soltmann 400,961
Telegraph apparatus for ships, J. B. Willis 400,985
Telephone, mechanical, G. Thomas 401,227
Telephone support, P. E. Hall 400,911
Thermo-dynamic motor, internal combustion, J. Hargreaves 401,161
Thill coupling, C. R. Jones 401,170
Tie. See Loop tie.
Timepiece, electric self-winding, Carranza & Tino 401,006
Tire, wagon, A. N. Hopkins 401,275
Tobacco tamp, and pipestem cleaner, combined, J. Strachan 400,966
Tooth, artificial, C. H. Land 400,921
Track layer, Roberts & Caldwell 400,950
Track lifter, J. T. Wiltfong 401,236
Trap. See Pipe trap.
Trough. See Feed trough.
Trunk lock, H. B. Plumb 401,062
Truss, A. C. Haines 400,910
Tube cutter, Jerreld, Sr., & Barclay 401,279
Tube or conduit, G. H. & K. C. Gillette 401,154
Tubing, apparatus for the manufacture of metal, J. H. Flagler 401,143, 401,144
Tubing, apparatus for welding, J. H. Flagler 401,146
Tubing, forming seamless, J. H. Flagler 401,145
Tubing, making metal, J. H. Flagler 401,142
Valve, L. Atwood 401,240
Valve controller, electric, W. E. Norris 401,200
Valve for gas distributing pipes, liquid safety, J. C. Conroy 401,135
Valve for tanks, cut-off, N. W. Krouse 400,920
Valve, hopper, C. Sturm 401,081
Valve reseating tool, P. J. Wright 400,989
Valve, slide, H. C. Reagan 401,209
Valve, steam engine, S. M. Keplinger 400,919
Vat. See Dyeing vat.
Vehicle brake, T. S. Smith 401,224
Vehicle seat, J. Lea 401,179
Vehicle side spring, G. B. Hamlin 401,272
Vehicle spring, E. Cliff 401,135
Velocipede, M. A. Norton 401,295
Velocipede, C. E. W. Woodward 401,237
Velocipede saddle, J. B. Brooks 401,123
Vending apparatus, liquid, Butz & Pederson 401,258
Wagon box corner iron, P. Andersen 401,100
Wagon brake, P. Pilon 400,942
Wagon seat, R. G. Stone 401,079
Walking stick, Pilon & Ploudre 401,061
Washboard, G. P. Fuller 401,265
Washing machine, C. Brandtner 401,000
Washing machine, S. J. & C. Mantle 401,190
Washing machine, F. W. Tiemann 401,228
Watch, stem winding and setting, E. Seitz 401,074
Water closets, cistern valve for, J. Wicks 400,982
Water cooler, W. H. Fruen 401,263
Water power, system for utilizing, W. Orr 400,940
Water purifying apparatus, J. B. Love 401,186
Weaving cane work, etc., machine for inserting diagonal strips in, H. B. Morris 401,050
Weighing machine, automatic grain, H. H. Boenker 401,118
Well curb attachment, J. T. Lenoir 401,040
Wheat steaming apparatus, G. Littlefield 401,085
Wheel. See Wind wheel.
Wheel, J. Frenier 400,907
Wheel, W. N. Stroud 401,080
Whitewash, D. Brizzolari 401,122
Wick tubes, former for restoring bent, J. S. White 401,234
Wind wheel, W. Ecker 401,139
Windlass, A. Voss 401,316
Windmill, Beebe & Stoner 400,995
Window cleaner, fountain, H. W. Munch 400,937
Windows, combination alarm lock for, J. B. Finch 401,148
Wine bin, G. King 401,175
Wire tightener, H. W. Campbell 401,004
Work box, C. Latschar 401,037
Zinc furnace, G. M. Westman 401,088

DESIGNS.

Brush or mirror back and handle, W. M. Welling .. 19,045
Carpet, J. L. Folsom ..... 19,007 to 19,015
Carpet, H. Horan ..... 19,013 to 19,025
Carpet, H. Hunt ..... 19,026 to 19,028
Carpet, E. Poole ..... 19,040 to 19,042
Electrical conductors, coupling for, J. E. Lee 19,038
Oil cloth, C. T. & V. E. Meyer ..... 19,031 to 19,039
Picture hook, W. A. Williamson 19,046
Pipe collar and flue stopper, J. I. Flanagen 19,006
Pipe collar and flue stopper, Z. T. Hall 19,016
Pipe collar and flue stopper, J. B. Rohrman 19,043
Scissors, H. H. Howard 19,029
Square, T., E. G. Soltmann 19,044
Stove, box, H. C. Bascom 19,005

TRADE MARKS.

Baking powder, J. E. Titsworth 16,481
Banjos, S. S. Stewart 16,480
Belting, hose, packing, and other rubber goods forming parts of machinery, Boston Belting Company 16,463, 16,464
Boots and shoes, Pingree & Smith 16,476
Canned salmon, Western Alaska Packing Company 16,484
Cotton and thread, spool, Tootal Broadhurst Lee Company 16,482
Cream for the acceleration of the mammary growth, J. A. Chard 16,466
Cutlery and plate, J. Rodgers & Sons 16,478
Dress shields, C. Boulenger 16,465
Dress shields and protectors, P. P. Guillaume, Fils Aîne 16,469
Electrical, telegraphic, and telephonic apparatus or instruments, Phonopore Syndicate 16,477
Eye healing water, T. McGuire 16,475
Game, M. Lyman 16,473
Hats, men's and boys', Ward, Goldthwaite & Co 16,483
Ice cream freezers, White Mountain Freezer Company 16,487
Medical compound for purifying the blood, C. R. King 16,471
Medicine for the liver, stomach, and kidneys, and liniment, worm remover, and salve, H. Schindhelm 16,479
Petroleum jelly for medicinal and toilet purposes, Lehn & Fink 16,472
Preparation for treatment of the feet, E. P. Weston 16,485
Rum, H. White & Co 16,486
Salve, A. F. Humphrey 16,470
Shirts, D. McCarthy & Sons 16,474
Soporific preparation, Farbenfabriken, vormals Fr. Bayer & Co 16,468
Underwear for men and women, and aprons, J. P. Cooper & Son 16,467

A printed copy of the specification and drawing of any patent in the foregoing list will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

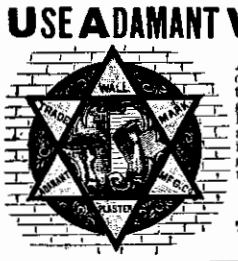
Canadian Patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

USE ADAMANT WALL PLASTER



It is **Hard, Dense, and Adhesive.** Does not *check or crack.* It is impervious to wind, water, and disease germs. It dries in a few hours. It can be applied in any kind of weather. It is in general use. Licenses granted for the mixing, using, and selling. Address

ADAMANT MFG. CO.
71 E. Genesee Street, Syracuse, N. Y.

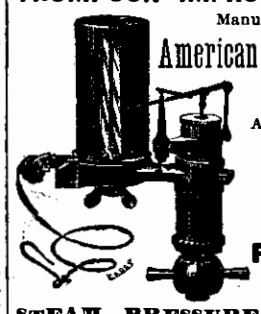
ICE-HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. Four engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, **59.** Price 10 cents. To be had at this office and of all newsdealers.

Patent Foot Power Machinery.
Complete Outfits.

Wood or Metal workers without steam power, can successfully compete with the large shops, by using our New **LABOR SAVING Machinery;** latest and most improved for practical shop use, also for Industrial Schools, Home Training, etc. Catalogue free.
Seneca Falls Mfg. Co.
695 Water Street, Seneca Falls, N. Y.

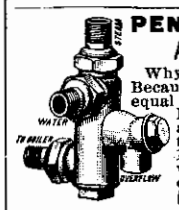
ICE-HOUSE AND REFRIGERATOR. Directions and Dimensions for construction, with one illustration of cold house for preserving fruit from season to season. The air is kept dry and pure throughout the year at a temperature of from 34° to 36°. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **116.** Price 10 cents. To be had at this office and of all newsdealers.

THOMPSON IMPROVED INDICATOR



Manufactured solely by
American Steam Gauge Co.
2,000 IN USE.
Adopted by the U. S. Navy on all the government cruisers and gunboats to be built.
Also Manufacturers of
POP SAFETY VALVES,
STEAM PRESSURE GAUGES, ETC.
34 Chardon Street, Boston, Mass.

THE MICRO-ORGANISMS OF AIR and Water. By Percy F. Frankland.—An account of a series of observations made to trace the seasonal variations in the number of micro-organisms in the air and water. With 3 figures of apparatus. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **663.** Price 10 cents. To be had at this office and from all newsdealers.



PENBERTHY IMPROVED AUTOMATIC INJECTOR.
Why 20,000 have been sold in two years. Because they cost less than others and do equal work. Lift 20 feet and work from head as well. Re-start themselves and require no watching. Will lift through hot pipes, work from 25 to 150 lbs. pressure. Parts removable without disconnecting, also interchangeable. Send for pamphlet.
Penberthy Injector Co., Detroit, Mich.

THE SUN MOTOR.—A DESCRIPTION, by John Ericsson, of the nature and arrangement of the reflecting mirrors adopted by him for increasing the intensity of the solar heat utilized for propelling the piston of the sun motor. With 2 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **663.** Price 10 cents. To be had at this office and from all newsdealers.

ELECTRICAL ENGINEERS
Send to **American Watch Tool Co.,** Waltham, Mass., for circular of No. 3 Bench Lathe. A Screw Cutting Lathe 32 in. by 7 in. swing.

MODERN LANGUAGES.—A PAPER by Prof. Charles F. Kroeh, describing the various methods of teaching and learning modern languages, with criticisms of the same. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **639.** Price 10 cents. To be had at this office and from all newsdealers.

Shepard's New $60 Screw-Cutting Foot Lathe

Foot and Power Lathes, Drill Presses, Scroll Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc.
Lathes on trial. Lathes on payment.
Send for catalogue of Outfits for Amateurs or Artisans.
Address **H. L. SHEPARD, AGENT,**
134 East 2d Street, Cincinnati, Ohio.

ELECTRICAL STRESS.—AN INTERESTING paper by Prof. A. W. Rucker, on the stresses that exist in a dielectric between conductors of different potentials. With 9 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **646.** Price 10 cents. To be had at this office and from all newsdealers.

PHOTOGRAPHS.
The photographing of Machinery, Bridges, Factories, and Iron Work of all descriptions. Write for samples.
GEO. P. HALL & SON, 157 Fulton Street, New York.

TIMBER AND SOME OF ITS DISEASES.—An elaborate and very valuable series of papers showing the various causes of the decay of timber and how in many cases it can be prevented. Illustrated with 39 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **637, 638, 640, 643, 644, 648, 656, 661, 664, 665.** Price 10 cents each, or $1 for the entire series. To be had at this office and from all newsdealers.

C & C ELECTRIC MOTORS
FROM ⅛ HORSE POWER UP FOR DRIVING LATHES, VENTILATING FANS, SEWING MACHINES, PUMPS, ELEVATORS, PRINTING PRESSES ETC.
THESE MOTORS RUN BY ELECTRIC CURRENT FROM ARC OR INCANDESCENT LIGHT CIRCUITS OR STORAGE BATTERIES.
THE C & C ELECTRIC MOTOR CO.

SEBASTIAN, MAY & CO'S
Improved Screw Cutting
Foot & Power LATHES

Drill Presses, Chucks, Drills, Dogs, and machinists' and amateurs' outfits. *Lathes on trial.* Catalogues mailed on application.
165 W. 2d St., Cincinnati, O.

PERSONAL IDENTIFICATION AND Description.—By Francis Galton, F.R.S. An interesting paper upon the application of the examination of hand and finger markings to the identification of individuals. With three illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **659.** Price 10 cents. To be had at this office and from all newsdealers.

Barnes' Patent Foot Power Machinery.
WORKERS OF WOOD OR METAL,

without steam power, by using outfits of these Machines, can bid lower, and save more money from their jobs, than by any other means for doing their work. Also for
Industrial Schools or Home Training.
With them boys can acquire practical journeymen's trades before they "go for themselves." Price-List Catalogue Free.
W. F. & JOHN BARNESCO.,
No. 1999 Ruby St., Rockford, Ill.

A FIVEFOLD COMET.—DESCRIPTION and illustration of the remarkable comet of January, 1887, which was divided into five, probably through the disturbing effects of the sun. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **633.** Price 10 cents. To be had at this office and from all newsdealers.

JUST OUT!
ALUMINUM-STEEL HACK SAW.
Frame and 1 doz. blades, $2; Blades per doz., 8-inch, $1, by mail upon receipt of price. Hard but not brittle.
CRESCENT MFG. CO., CLEVELAND, O.
New catalogue of Engineers' Specialties.

INFLUENCE MACHINES.—A PAPER by James Wimshurst, giving a complete account of the recent forms of generators of static electricity. With 13 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **647.** Price 10 cents. To be had at this office and from all newsdealers.

DISTRIBUTING HEAT AND POWER.—Full description, by E. D. Meier, of the Prall system of distributing heat and power from central stations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **660.** Price 10 cents. To be had at this office and from all newsdealers.

TO BUSINESS MEN.
The value of the SCIENTIFIC AMERICAN as an advertising medium cannot be overestimated. Its circulation is many times greater than that of any similar journal now published. It goes into all the States and Territories, and is read in all the principal libraries and reading rooms of the world. A business man wants something more than to see his advertisement in a printed newspaper. He wants circulation. This he has when he advertises in the SCIENTIFIC AMERICAN. And do not let the advertising agent influence you to substitute some other paper for the SCIENTIFIC AMERICAN, when selecting a list of publications in which you decide it is for your interest to advertise. This is frequently done, for the reason that the agent gets a larger commission from the papers having a small circulation than is allowed on the SCIENTIFIC AMERICAN.
For rates see top of first column of this page, or address
MUNN & CO., Publishers,
361 Broadway, New York.

HOME-MADE INCUBATOR.—PRACTICAL directions for the manufacture of an effective incubator that has been carefully tested and found to perform all that may be reasonably expected; with directions for operating. With 4 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **630.** Price 10 cents. To be had at this office and from all newsdealers.

DO YOUR OWN PLATING
Either in Gold, Silver, or Nickel, and Electrotyping. Complete sets of each, with practical instruction that any person may learn the art easily. Send for catalogue and price list to THOS. HALL, Mfg. Electrician and Optician, 19 Bromfield Street, Boston, Mass.

MOULDERS' TOOLS.—A DESCRIPTION of the tools used by foundry moulders and their uses. With illustrations of the different implements. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **636.** Price 10 cents. To be had at this office and from all newsdealers.

BARREL, KEG, Hogshead, AND STAVE MACHINERY.
Over 50 varieties manufactured by
E. & B. HOLMES,
BUFFALO, N. Y.
Chamfering, Howeling, and Crozing.

THE CRANK'S STORY.—BY G. H. Edwards, C.E. The part played by the crank in developing the economy of steam in multiple cylinder engines. With two figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **641.** Price 10 cents. To be had at this office and from all newsdealers.

Stored Energy
ACCUMULATORS for Electric Lighting and Street Car Propulsion.
ELECTRICAL ACCUMULATOR COMPANY,
No. 44 Broadway, New York City.

Edco System.
Complete Electric Light and Power Plants. Street Cars equipped for Electric Propulsion. The oldest and most experienced Electric Motor Co. in the world.
THE ELECTRO DYNAMIC COMPANY,
No. 224 Carter St., Philadelphia, Pa.

© 1889 SCIENTIFIC AMERICAN, INC

Founded by Mathew Carey, 1785.

HENRY CAREY BAIRD & CO.
Industrial Publishers, Booksellers, and Importers,
810 Walnut St., Philadelphia, Pa., U. S. A.

☞Our new and Revised Catalogue of Practical and Scientific Books, 84 pages, 8vo, and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

ARCHITECTURAL BOOKS.

Useful, Beautiful, and Cheap.

To any person about to erect a dwelling house or stable, either in the country or city, or any builder wishing to examine the latest and best plans for a church, school house, club house, or any other public building of high or low cost, should procure a complete set of the ARCHITECTS' AND BUILDERS' EDITION of the SCIENTIFIC AMERICAN.

The information these volumes contain renders the work almost indispensable to the architect and builder, and to persons about to build for themselves they will find the work suggestive and most useful. They contain colored plates of the elevation, plan, and detail drawings of almost every class of building, with specification and approximate cost.

Four bound volumes are now ready and may be obtained, by mail, direct from the publishers or from any newsdealer. Price, $2.00 a volume. Stitched in paper covers. Subscription price, per annum, $2.50. Address and remit to

MUNN & CO., Publishers,
361 Broadway, New York.

100 Lessons in BUSINESS.

Something Entirely New.

20,000 copies sold in six months. One of the most successful books published in this country. Checks and other business forms reproduced in colors from actual commercial paper. Short cuts in figures from many foreign sources. Beautifully bound. Mailed to any address in the world for **One Dollar.** Valuable circulars free. Address

SEYMOUR EATON,
50 Bromfield Street, BOSTON, MASS.

IRON AND STEEL, ANALYSIS OF.—A description of the methods employed for determining the several constituents contained in these metals. With one illustration. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 661. Price 10 cents. To be had at this office and from all newsdealers.

OIL WELL SUPPLY CO. Ltd.
91 & 92 WATER STREET,
Pittsburgh, Pa.,
Manufacturers of everything needed for
ARTESIAN WELLS
for either Gas, Oil, Water, or Mineral Tests, Boilers, Engines, Pipe, Cordage, Drilling Tools, etc. Illustrated catalogue, price lists and discount sheets on request.

MARINE SIGNALS.—DESCRIPTION of various types of foghorns, sirens, buoys, lightships, and other forms of marine signals. With 23 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 666. Price 10 cents. To be had at this office and from all newsdealers.

ARTESIAN
Wells, Oil and Gas Wells, drilled by contract to any depth, from 50 to 3000 feet. We also manufacture and furnish everything required to drill and complete same. Portable Horse Power and Mounted Steam Drilling Machines for 100 to 600 ft. Send 6 cents for illustrated catalogue. **Pierce Artesian and Oil Well Supply Co.,** 80 Beaver Street, New York.

ADVICE TO YOUNG MECHANICAL Engineers.—Address by Prof. Perry, to his students at the Finsbury Technical College. A paper of great value and interest to all working engineers. With one engraving. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 661. Price 10 cents. To be had at this office and from all newsdealers.

Clark's Noiseless Rubber Truck Wheels
Save floors. Anti-Friction Casters. Rubber Furniture Casters, etc, Catalogue free.
Geo. P. Clark, Box L, Windsor Locks, Ct.

PETROLEUM BOAT. DESCRIPTION of a petroleum motor devised by Mr. Lenoir for the propulsion of small boats. With 2 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 637. Price 10 cents. To be had at this office and from all newsdealers.

PERFECT NEWSPAPER FILE
The Koch Patent File, for preserving newspapers, Magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper. Address
MUNN & CO., Publishers SCIENTIFIC AMERICA.

CURE for the DEAF by Peck's Pat. Improved Cushioned Ear Drums. Whispers heard distinctly. Comfortable, invisible. Illustrated book & proofs, FREE. Address or call on F. HISCOX, 853 Broadway, N. Y. Name this paper.

STANDARD TOOL CO.
ATHOL, MASS.
MANUFACTURERS OF
The Celebrated Chaplin Try and Center Square, Standard Steel Rules, Steel Caliper Rules, Universal Bevel, Caliper Gauges, Improved Surface Gauges, Bevel Protractors, Depth Gauges, Screw Pitch and Center Gauges, Hardened Steel Squares, Graduated Steel Squares, Spring Calipers, Pliers, Straight Edges, etc., etc.
WRITE FOR ILLUSTRATED CATALOGUE AND PRICE LIST OF FULL LINE.

WATER OF CONDENSATION.—A description of the various apparatus that have been devised for the extraction of water of condensation from the steam-heated apparatus used in the industries. With 24 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 659. Price 10 cents. To be had at this office, and from all newsdealers.

PATENT IRONING BOARD.

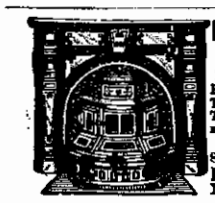
The cheapest, best, and simplest Ironing Board on the market.
Price, $1.50 each.
Liberal discount to the trade. State Rights for sale. Apply to
WEST MONROE IRONING CO.,
27 West Monroe Street, NEWARK, N. J.

PULLEYS. Cheapest, Lightest, and Best. Made by Hardwood Split P. Co., Menasha, Wis.

USEFUL BOOKS.
Manufacturers, Agriculturists, Chemists, Engineers, Mechanics, Builders, men of leisure, and professional men, of all classes, need good books in the line of their respective callings. Our post office department permits the transmission of books through the mails at very small cost. A comprehensive catalogue of useful books by different authors, on more than fifty different subjects, has recently been published for free circulation at the office of this paper. Subjects classified with names of author. Persons desiring a copy, have only to ask for it, and it will be mailed to them. Address,
MUNN & CO., 361 Broadway, New York.

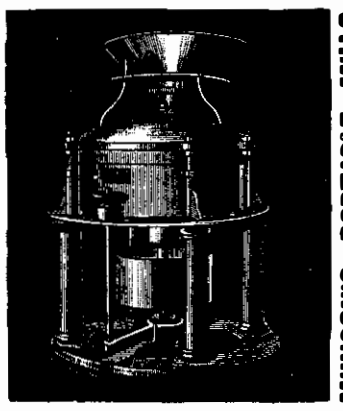
DRY AIR REFRIGERATING MACHINE. Description of Hall's improved horizontal dry air refrigerator, designed to deliver about 10,000 cubic feet of cold air per hour, when running at a speed of 100 revolutions per minute, and capable of reducing the temperature of 90° above to 50° below zero. With five figures, showing plan and side elevation of the apparatus, and diagrams illustrative of its performance. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 288. Price 10 cents. To be had at this office and from all newsdealers.

HOW EARTHQUAKES ARE MEASured.—A paper by Prof. J. A. Ewing, describing the principles and applications of various seismographs. With four engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 659. Price 10 cents. To be had at this office and from all newsdealers.



BIBB'S Celebrated Original BALTIMORE FIRE-PLACE HEATERS
To warm upper and lower rooms The Handsomest and Most Economical Coal Stoves in the world.
B. C. BIBB & SON
Stove Founders, Baltimore, Md.
MARBLEIZED SLATE MANTELS New and Beautiful Designs.

BOFORS CAST STEEL GUN—BY Capt. O. E. Michaelis, U.S.A.—The production of guns from unforged open hearth steel by the casting process. The excellent quality of the guns produced, and their freedom from blow holes. A plea for cast steel ordnance. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 663. Price 10 cents. To be had at this office and from all newsdealers.



MUNSON'S PORTABLE MILLS,
AND MILL FURNISHINGS,
MANUFACTURED BY MUNSON BROTHERS, UTICA, N. Y., U. S. A.

MODERN CAVALRY ON THE FIELD of Battle.—By Col. R. S. Liddell. An interesting historical resume of what has been accomplished by the cavalry in various notable battles, and discussing the value of this branch of the service. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 664. Price 10 cents. To be had at this office and from all newsdealers.

ASBESTOS PIPE COVERINGS
Made entirely of ASBESTOS.
Absolutely Fire Proof.
BRAIDED PACKING, MILL BOARD, SHEATHING, CEMENT, FIBRE AND SPECIALTIES.
CHALMERS-SPENCE CO., FOOT E. 8TH ST., N. Y.
BRANCHES: Phila, 24 Strawberry St. Chicago, 86 E. Lake St. Pittsburg, 37 Lewis Block.

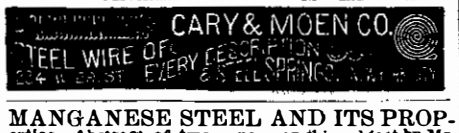
GEOLOGY.—A VALUABLE AND INteresting paper by Prof. A. Geike, upon rock formation. Different kinds of stones. What stones have to tell us. Sedimentary rocks. How gravel, sand, and mud are made, and how they become rocks. How the remains of plants and animals came to be found in sedimentary rocks. A quarry and its lessons. Organic rocks. What igneous rocks are, and where they come from. Crust of the earth. The origin of mountains. How the rocks tell the history of the earth. With 46 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 658, 659, 660, 661, and 662. Price 10 cents each, or 50 cents for the series. To be had at this office and from all newsdealers.

Only $5.50 per 100 for Pen and Pencil Frames.
Little Gem or Midget, $1.75 doz. Watch Stamp, $2.75 doz. 3-blade Knife Stamps, $6 doz. Stamp Gum, 85c. lb. or 10 lbs. $7.50. Pencil Tops, $6 per 100. Pocket Stamp No. 14, $7 per 100. Puzzle Key Rings, $2.50 per 100. Stamp Handles 50c. per 100 or $3.85 per 1,000. All colors Ink in Brass Tubes, $1.50 per 100, or $13.50 per 1,000. Band Daters 60c. each; $5.50 doz.
Complete Directions for Manufacturing your own Rubber Stamps with THALMAN'S IMPROVED VULCANIZER, REDUCED TO $3.50
☞We have started persons who are now doing a thriving business. Remit above amount at once, which will be a stepping Stone to a prosperous future. ADDRESS
THALMAN MFG. CO., P. 15, Baltimore, Md.

CONCRETE.—BY JOHN LANDIS. Practical notes on the mixing and manipulation of cements. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 643. Price 10 cents. To be had at this office and from all newsdealers.

ROSE POLYTECHNIC INSTITUTE,
TERRE HAUTE, IND.—A SCHOOL OF ENGINEERING.
Well endowed, well equipped departments of Mechanical and Civil Engineering. Electricity, Chemistry, Drawing. Shops and Laboratories. Expenses low. Address T. C. Mendenhall, Pres.

POLAR PLANIMETER.—A PAPER by E. A. Giessler, C.E., giving the theory and use of this useful instrument. With 5 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 637. Price 10 cents. To be had at this office and from all newsdealers.



MANGANESE STEEL AND ITS PROPerties.—Abstract of two papers on this subject by Mr. Robert A. Hadfield, Assoc. M. Inst. C.E. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 640. Price 10 cents. To be had at this office and from all newsdealers.

THE PENNA. DIAMOND DRILL & MFG. CO.
BIRDSBORO, PA., Builders of High Class Steam Engines, Diamond Drilling and General Machinery. Flour Mill Rolls Ground and Grooved.

WATCH CLEANING AND REPAIRing.—A valuable and practical paper, full of useful suggestions. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 664. Price 10 cents. To be had at this office and from all newsdealers.

JAMES B. EADS.—AN ACCOUNT OF the life and labors of this eminent engineer. With a portrait. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 592. Price 10 cents. To be had at this office and from all newsdealers.

TUBING. MANDREL DRAWN for All Purposes.
Model and Experimental Machinery.
J. C. SLACK, Greenpoint, N. Y.

FAST TRAINS.—FOUR HUNDRED Miles in 8 hours.—Record of the fastest train service in the world, recently established in England; details of speed. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 665. Price 10 cents. To be had at this office and from all newsdealers.

ROYAL MICROSCOPIC SOCIETY.—Annual address by the President, Dr. Dallinger, F.R.S., delivered Feb. 8, 1888. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 643. Price 10 cents. To be had at this office and from all newsdealers.

2nd MACHINERY Lists Sent.
N. Y. Mach'y Depot, Bridge Store 16, Frankfort St., N.Y.

BRIDGE CONSTRUCTION, DEVELopment of.—A paper by Prof. W. P. Trowbridge, giving a history of the art of building bridges, along with notices of some remarkable historic bridges. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 637. Price 10 cents. To be had at this office and from all newsdealers.

BONANZA to AGENTS SAMPLES FREE both sexes. Write now GEO. A. SCOTT, New York City

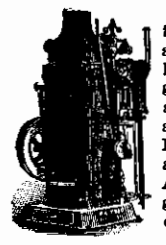
ANÆSTHETICS, A LESSON FOR those who use.—By J. J. Chisholm, M.D. Remarkable cases of resuscitation of patients apparently dead from the inhalation of chloroform, with methods used. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 642. Price 10 cents. To be had at this office and from all newsdealers.

AGENTS WANTED ON SALARY. $75 per month and expenses paid any active man or woman to sell our goods by sample and live at home. Salary paid promptly and expenses in advance. Full particulars and sample case FREE. We mean just what we say. Address Standard Silverware Co., Boston, Mass.

ROPE TRANSMISSION OF POWER.—Some valuable suggestions to those who would apply rope in place of leather belting for the transmission of power over long distances. With 12 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 638. Price 10 cents. To be had at this office and from all newsdealers.

25% TO 50% SAVING THE MACKEY AUTOMATIC SPRINKLER
Thermostatic Fire Alarm operated by Electricity.
Positive in its action. Easily tested. No attendance required. Endorsed by Underwriters. The J. C. Mackey Co., 76-80 So. Water St., Syracuse, N. Y., U. S. A.

THE NEW BAXTER ENGINE
Rope and Twine Machinery, and Manufacturer of Binder Twine, etc.



This Engine is made with all latest improvements, from 1 to 15 H. P., and has a record unsurpassed in the history of steam motors. Every engine is provided with all economic and safety appliances known, and are warranted in every respect. Every description of Rope and Cordage, Twine and Bagging Machinery. And also manufacturer of Jute Bagging, Hemp and Flax Binder Twine, etc. Send for circulars. Address,
JOSEPH C. TODD,
Please mention this paper. 38 Dey St., New York.

Proposals for Search-Light Outfits.—*April 6, 1889.*—Sealed proposals, endorsed "Proposals for Search-Light Outfits," will be received at the Bureau of Provisions and Clothing, Navy Department, Washington, D. C., until 11 o'clock A. M., April 29, 1889, and publicly opened immediately thereafter, to furnish one search-light outfit, complete, except dynamo and engines, to each of the following vessels, viz, "Philadelphia," "Newark," and "San Francisco." Blank proposals and all information regarding the articles required can be obtained upon application to the commanding officer of the Torpedo Station, Newport, Rhode Island. The bids decided by lot. The Department reserves the right to reject any proposal not deemed advantageous to the Government.
JAMES FULTON, *Paymaster General, U. S. Navy.*

MODELS Experimental Work & Light Machinery
N. ERLANDSEN, 107 Rivington Street, N. Y.

YELLOWSTONE PARK.—AN INteresting description of this region of wonders, with its hot springs, geysers, caves, lakes, etc. With 11 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 663. Price 10 cents. To be had at this office and from all newsdealers.

VOLNEY W. MASON & CO.,
FRICTION PULLEYS CLUTCHES and ELEVATORS
PROVIDENCE, R. I.

PETROLEUM FUEL.—AN ACCOUNT of the Pennsylvania Railroad's experiments with the Urquhart system of burning petroleum on locomotives, and also of the experience of the Grazi-Haritzin Railroad with coal oil as a fuel. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 615. Price ten cents. To be had at this office and from all newsdealers.

FOREIGN PATENTS
THEIR COST REDUCED.

The expenses attending the procuring of patents in most foreign countries having been consider bly reduced the obstacle of cost is no longer in the way of a large proportion of our inventors patenting their inventions abroad.

CANADA.—The cost of a patent in Canada is even less than the cost of a United States patent, and the former includes the Provinces of Ontario, Quebec, New Brunswick, Nova Scotia, British Columbia, and Manitoba.

The number of our patentees who avail themselves of the cheap and easy method now offered for obtaining patents in Canada is very large, and is steadily increasing.

ENGLAND.—The new English law, which went into force on Jan. 1st, 1885, enables parties to secure patents in Great Britain on very moderate terms. A British patent includes England, Scotland, Wales, Ireland and the Channel Islands. Great Britain is the acknowledged financial and commercial center of the world, and her goods are sent to every quarter of the globe. A good invention is likely to realize as much for the patentee in England as his United States patent produces for him at home, and the small cost now renders it possible for almost every patentee in this country to secure a patent in Great Britain, where his rights are as well protected as in the United States.

OTHER COUNTRIES.—Patents are also obtained on very reasonable terms in France, Belgium, Germany, Austria, Russia, Italy, Spain (the latter includes Cuba and all the other Spanish Colonies), Brazil, British India Australia, and the other British Colonies.

An experience of FORTY years has enabled the publishers of THE SCIENTIFIC AMERICAN to establish competent and trustworthy agencies in all the principal foreign countries, and it has always been their aim to have the business of their clients promptly and properly done and their interests faithfully guarded.

A pamphlet containing a synopsis of the patent laws of all countries, including the cost for each, and other information useful to persons contemplating the procuring of patents abroad, may be had on application to this office.

MUNN & CO., Editors and Proprietors of THE SCIENTIFIC AMERICAN, cordially invite all persons desiring any information relative to patents, or the registry of trade-marks, in this country or abroad, to call at their offices, 361 Broadway. Examination of inventions, consultation, and advice free. Inquiries by mail promptly answered,

Address, **MUNN & CO.,**
Publishers and Patent Solicitors,
361 Broadway, New York.

BRANCH OFFICES: No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

The Scientific American

PUBLICATIONS FOR 1889.

The prices of the different publications in the United States, Canada, and Mexico are as follows:

RATES BY MAIL.

The Scientific American (weekly), one year	$3.00
The Scientific American Supplement (weekly), one year	5.00
The Scientific American, Export Edition (monthly) one year	5.00
The Scientific American, Architects and Builders Edition (monthly), one year	2.50

COMBINED RATES.

The Scientific American and Supplement	$7.00
The Scientific American and Architects and Builders Edition	5.00
The Scientific American, Supplement, and Architects and Builders Edition	9.00

Proportionate Rates for Six Months.

This includes postage, which we pay. Remit by postal or express money order, or draft to order of
MUNN & CO., 361 Broadway, New York.

WORKING MODELS & LIGHT MACHINERY. INVENTIONS DEVELOPED. Send for Model Circular. Jones Bros. E Co., Cin'ti. O.

© 1889 SCIENTIFIC AMERICAN, INC

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

RIDE CYCLES!
VICTORS ARE BEST!
Bicycles, Tricycles, and Safeties.
Send for free illustrated Catalogue.
Overman Wheel Co., Makers,
BOSTON, MASS.

THE COPYING PAD.—HOW TO MAKE and how to use; with an engraving. Practical directions how to prepare the gelatine pad, and also the aniline ink by which the copies are made: how to apply the written letter to the pad; how to take off copies of the letter. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 438. Price 10 cents. For sale at this office and by all newsdealers in all parts of the country.

THE KODAK CAMERA

Makes 100 Instantaneous Pictures by simply pressing a button. Anybody can use it who can wind a watch. No focusing. No tripod. Rapid Rectilinear Lens. Photographs moving objects. Can be used indoors.

Division of Labor—Operator can finish his own pictures, or send them to the factory to be finished.

Morocco covered Camera, in handsome sole-leather case, loaded for 100 pictures, For full description of "Kodak" see SCI. AM., Sept. 15, '88.

Price, $25.00. Reloading, $2.00.
The Eastman Dry Plate & Film Co.
Rochester, N. Y. 115 Oxford St., London.
Send for copy of Kodak Primer with Kodak Photograph.

THE PHONOGRAPH.—A DETAILED description of the new and improved form of the phonograph just brought out by Edison. With 8 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 632. Price 10 cents. To be had at this office and from all newsdealers.

THE ARMSTRONG MFG. CO.
BRIDGEPORT, CONN.
WATER, GAS AND STEAM FITTERS' TOOLS.

Stocks and Dies for Pipe, Bolts, and Brass Pipe, Wrenches, Pipe Vises, Pipe Cutters, etc.
Catalogues sent free on application.

THE EIFFEL TOWER.—AN EXCELlent engraving of the Eiffel one thousand-feet-high tower, which was opened to the public a few days ago, and which is to form a part of the French Exposition attractions, may be found, with description, in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 554. To be had from newsdealers or at this office. Price 10 cents.

What is more aggravating than leaky valves, whether in House, Office, or Factory? If you wish to avoid annoyance, INSIST on having Jenkins Bros. Valves. Accept no valves as Jenkins Bros. unless stamped with our "Trade Mark" like cut.

JENKINS BROS.
71 John Street, New York.
105 Milk Street, Boston.
21 North 5th Street, Phila.
54 Dearborn Street, Chicago.

ELECTRO MOTOR, SIMPLE, HOW TO make. By G. M. Hopkins.—Description of a small electro motor devised and constructed with a view to assisting amateurs to make a motor which might be driven with advantage by a current derived from a battery, and which would have sufficient power to operate a foot lathe or any machine requiring not over one man power. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641. Price 10 cents. To be had at this office and from all newsdealers.

THE RICHARDS OIL ENGINE

The Safest, Most Economical, and Most Convenient Engine. No Boiler, no Steam, no Coal, no Ashes, no Danger, no Extra Insurance, no Engineer, and next to no Attendance. Started instantly with a match. Speed and fuel completely regulated by the governor. All expense ceases when the engine stops. BINGHAMTON HYDRAULIC POWER CO., Sole Manufacturers, Binghamton, N. Y., U. S. A.

WIRING, SPECIFICATION OF.—Specification of Wiring for a proposed electrical installation in a large building. A paper of value to electrical engineers. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 667. Price 10 cents. To be had at this office and from all newsdealers.

MALLEABLE AND FINE GRAY IRON ALSO STEEL CASTINGS FROM SPECIAL PATTERNS
THOMAS DEVLIN & CO. FINE TINNING JAPANNING AND FINISHING
LEHIGH AVE. & AMERICAN ST. PHILA.

PATENTS.

MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for Inventors.

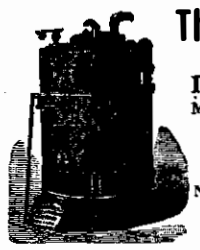
In this line of business they have had *forty-one years' experience*, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms.

A pamphlet sent free of charge, on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases. Hints on the Sale of Patents, etc.

We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world.

MUNN & CO., Solicitors of Patents,
361 Broadway, New York.

BRANCH OFFICES.—No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.



The Dunning Patent Wrought-Iron Boiler
With Self-Feeding Coal Magazine, is the best for
Low Pressure Steam or Hot Water Heating.
Made in eleven sizes, suitable to heat the smallest cottage or the largest building. Insures a warm house night and day. Burns Hard or Soft Coal, Wood, Coke, or Gas. Over 14,000 in use. Keeps steam up constantly. Also Steam Engines and Boilers of all kinds, and Machinery generally. Manufactured at the New York Central Iron Works, Lock Box 40, Geneva, N. Y., and Waterous Engine Works Co. (Limited), Brantford, Ontario, Canada.
Send for New Illustrated Catalogue.

THERMO-MAGNETIC GENERATOR and Motor.—Description of an apparatus devised by Mr. Menges for the purpose of generating electricity by the direct conversion of heat, or by a more direct conversion than that of an ordinary dynamo. With 5 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 633. Price 10 cents. To be had at this office and from all newsdealers.

OTTO GAS ENGINES.
Over 25,000 Sold.

Horizontal.....	Otto....	Gas Engines.
Vertical.....	Otto....	Gas Engines.
Twin Cylinder..	Otto....	Gas Engines.
Combined.....	Otto..	Gas Engines and Pumps.
Combined.....	Otto..	Gas Engines and Dynamos

OTTO GAS ENGINE WORKS,
CHICAGO, PHILADELPHIA.
New York Agency, 18 Vesey Street.

CHEMISTRY OF SUBSTANCES taking part in Putrefaction and Antisepsis.—Three lectures by John M. Thomson, F.R.S.E., describing some of the more important properties of such substances as take part in putrefaction and antisepsis, with the general bearings of some of the changes that lead to their production. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 635, 636, and 637. Price 10 cents each. To be had at this office and from all newsdealers.

VAN DUZEN GAS ENGINE
NO BOILER. NO COAL. NO ENGINEER.
No Extra WATER RENT or INSURANCE.
INSTANTLY STARTED.
DURABLE, RELIABLE, SAFE and ECONOMICAL.
Send for description and prices.
Van Duzen Gas Engine CO.,
53 E. 2nd St., CINCINNATI, O.

PATENTS FOR SALE.—Steam Trap, Back Pressure Valve, and Mechanical Boiler Cleaner. Investigate. Address TAYLOR BROS., New Orleans, La.

Scientific Book Catalogue
RECENTLY PUBLISHED.
Our new catalogue containing over 100 pages, including works on more than fifty different subjects. Will be mailed free to any address on application.
MUNN & CO., Publishers Scientific American,
361 Broadway, New York.

ARCHITECTURAL DESIGNS, ELEments of.—Two lectures by H. H. Statham. Treating of architecture as an intellectual art, whose aim is to render buildings objects of interest and beauty, and not mere utilitarian walls, floors, and roofs. With 76 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENTS, Nos. 633 and 634. Price, 10 cents each. To be obtained at this office and from all newsdealers.

INVENTORS and others desiring new articles manufactured and introduced, address P. O. Box 86, Cleveland, O.

TRIPLE THERMIC MOTOR.—DEscription, operation, and results of a single-expansion non-condensing steam engine, supplemented by the evaporation of the bisulphide of carbon and expansion of its vapor at the Brush Electric Works, Cleveland, Ohio. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641. Price 10 cents. To be had at this office and from all newsdealers.

SECTIONAL INSULATED AIR COVERINGS
FOR PIPES, BOILERS, DRUMS, AND ALL OTHER HOT & COLD SURFACES
SHIELDS & BROWN CO.
143 WORTH ST. NEW YORK. 240 & 242 RANDOLPH ST. CHICAGO.
ASBESTOS, CEMENT, PACKING, SHEATHING &C.

CANADIAN PACIFIC RAILWAY.—A paper by Mr. T. C. Keifer, read at the annual convention of the American Society of Civil Engineers in 1888. General location of the Canadian Pacific and its geographical features. The prairie section. The mountain section. Fuel supply. Locomotive equipment. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 657. Price 10 cents. To be had at this office and from all newsdealers.

CUTLER DESK. BEST IN THE WORLD. A. CUTLER & SON. BUFFALO, N.Y. U.S.A.

A NEW CATALOGUE —OF— VALUABLE PAPERS
Contained in SCIENTIFIC AMERICAN SUPPLEMENT, sent *free of charge* to any address.
MUNN & CO., 361 Broadway, New York.

ELECTRICAL WELDING.—DESCRIPtion of a method of welding by electricity devised by Mr. N. Von Benardos, of St. Petersburg. With 38 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 635. Price 10 cents. To be had at this office and from all newsdealers.

Improved Bench Centering Chuck.

Will perfectly center round, square, and octagon pieces from ¼ in. to 1¼ in. One of the most useful, durable, and labor saving tools ever made for centering purposes, and is being universally used. Price $12. Manufactured by THE CUSHMAN CHUCK CO., Hartford, Conn.

HARGREAVES' THERMO-MOTOR.—Full description of this new apparatus and explanation of the theory upon which it is based. Illustrated with 6 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 633. Price 10 cents. To be had at this office and from all newsdealers.

MOSS ENGRAVING Co. 535 PEARL & NEW YORK cor. Elm St.
OUR SPECIALTY: FINE ILLUSTRATED CATALOGUES
BY OUR NEW MOSS-TYPE PROCESS.
Send Green Stamp for Moss-Type Specimens.

TOXICOLOGY, PRESENT POSITION of.—A paper by J. D. Arnold, F.C.S., showing how limited is the number of poisons that can be detected in minute quantities in *post mortem* cases by the present methods in use. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 640. Price 10 cents. To be had at this office and from all newsdealers.

PATENT
JACKET KETTLES,
Plain or Porcelain Lined. Tested to 100 lb. pressure. Send for Lists.
HAND, BURR & CO.,
614 and 616 Market St., Philadelphia, Pa.

ELECTRICAL DISTRIBUTION OF Time.—By Allan D. Brown, U.S.N. A historical review of the evolution of the time service of to-day, and a discussion of the problem of using the electric current as a motive power for clocks. An elaborate and interesting paper. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 659. Price 10 cents. To be had at this office and from all newsdealers.

DEFEAT OF THE ARMADA IN 1588.—An interesting account of the Invincible Armada collected by Philip II., of Spain, for the subjugation of England, and particulars of the battle which resulted in its defeat. With three engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 660. Price 10 cents. To be had at this office and from all newsdealers.

PNEUMATIC DYNAMITE TORPEDO Gun.—An exhaustive account of this new weapon and of the experiments made with it; along with a description and illustration of a proposed dynamite cruiser, with 6 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 593. Price 10 cents. To be had at this office and from all newsdealers.

H.W. JOHNS' ASBESTOS STEAM PACKING
Boiler Coverings, Millboard, Roofing, Building Felt, Liquid Paints, Etc.
DESCRIPTIVE PRICE LIST AND SAMPLES SENT FREE.
H. W. JOHNS MFG. CO., 87 Maiden Lane, N.Y.

ALUMINUM, INFLUENCE OF, UPON Cast Iron.—A paper by W. J. Keep, C.E., giving the results of a series of carefully conducted tests to settle the question as to whether aluminum which has been added to iron remains therein after it has been cast. With 7 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 662. Price 10 cents. To be had at this office and from all newsdealers.

ROCK BREAKERS AND ORE CRUSHERS

We manufacture and supply at short notice and lowest rates, Stone and Ore Crushers, containing the invention described in Letters Patent issued to Eli W. Blake, June 15, 1858, together with NEW AND VALUABLE IMPROVEMENTS, for which Letter Patent were granted May 11th and July 30th, 1880, to Mr. S. L. Marsden. All Crushers supplied by us are constructed under the superintendence of Mr. Marsden, who, for the past twenty years, has been connected with the manufacture of Blake Crushers in this country and England.
FARREL FOUNDRY and MACHINE CO., Manufacturers, ANSONIA, CONN.
COPELAND & BACON, Agents, NEW YORK and PHILADELPHIA.

SYRACUSE MALLEABLE IRON WORKS
W. E. BURNS, PROP.
SEAMLESS TUBES.—DESCRIPTION of the various processes of manufacture; with 44 figures illustrative of the apparatus used. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 638. Price 10 cents. To be had at this office and from all newsdealers.

ERIE ENGINE WORKS WALNUT STREET, ERIE, PA. MANUFACTURERS OF STATIONARY PORTABLE AGRICULTURAL ENGINES STATIONARY PORTABLE VERTICAL BOILERS

THE AMERICAN BELL TELEPHONE CO.
95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30th, 1877, No. 186,787.

The transmission of Speech by all known forms of Electric Speaking Telephones infringes the right secured to this Company by the above patents, and renders each individual user of telephones not furnished by it or its licensees responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.

KEY SEATING Machines and 20" Drills. W. P. DAVIS, Rochester, N. Y.

THE
Scientific American
ESTABLISHED 1846.
The Most Popular Scientific Paper in the World.

Only $3.00 a Year, including Postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc. Complete List of Patents each week.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars** by the publishers; six months, $1.50; three months, $1.00.

Clubs.—Special rates for several names, and to Post Masters. Write for particulars.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
361 Broadway, New York.

THE
Scientific American Supplement.

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers, and accompanied with translated descriptions. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology, Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States and Canada, $5.00 a year, or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year for $7.00. Single copies 10 cents. Address and remit by postal order, express money order, or check,

MUNN & Co., 361 Broadway, N. Y.,
Publishers SCIENTIFIC AMERICAN.

Building Edition.

THE SCIENTIFIC AMERICAN ARCHITECTS' AND BUILDERS' EDITION is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming a large and splendid **Magazine of Architecture**, richly adorned with *elegant plates in colors*, and with other fine engravings; illustrating the most interesting examples of modern Architectural Construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with full Plans, Specifications, Sheets of Details, Estimates, etc.

The elegance and cheapness of this magnificent work have won for it the **Largest Circulation** of any Architectural publication in the world. Sold by all newsdealers. $2.50 a year. Remit to

MUNN & CO., Publishers,
361 Broadway, New York.

PRINTING INKS.
THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Phila., and 47 Rose St., opp. Duane St., N. Y.

© 1889 SCIENTIFIC AMERICAN, INC